Model 700
Gas Chromatograph

System Reference Manual

Applies to Both
Daniel Danalyzer Model 700
Rosemount Analytical Model 700

Part Number 3-9000-521
Revision M

JULY 2007

EMERSON
Process Management

Model 700 Gas Chromatograph
System Reference Manual

NOTICE

DANIEL MEASUREMENT AND CONTROL, INC. AND ROSEMOUNT ANALYTICAL, INC. (COLLECTIVELY, "SELLER") SHALL NOT BE LIABLE FOR TECHNICAL OR EDITORIAL ERRORS IN THIS MANUAL OR OMISSIONS FROM THIS MANUAL. SELLER MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THIS MANUAL AND, IN NO EVENT, SHALL SELLER BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PRODUCTION, LOSS OF PROFITS, ETC.

PRODUCT NAMES USED HEREIN ARE FOR MANUFACTURER OR SUPPLIER IDENTIFICATIO ONLY AND MAY BE TRADEMARKS/REGISTERED TRADEMARKS OF THESE COMPANIES.

THE CONTENTS OF THIS PUBLICATION ARE PRESENTED FOR INFORMATIONAL PURPOSES ONLY, AND WHILE EVERY EFFORT HAS BEEN MADE TO ENSURE THEIR ACCURACY, THEY ARE NOT TO BE CONSTRUED AS WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED, REGARDING THE PRODUCTS OR SERVICES DESCRIBED HEREIN OR THEIR USE OR APPLICABILITY. WE RESERVE THE RIGHT TO MODIFY OR IMPROVE THE DESIGNS OR SPECIFICATIONS OF SUCH PRODUCTS AT ANY TIME.

SELLER DOES NOT ASSUME RESPONSIBILITY FOR THE SELECTION, USE OR MAINTENANCE OF ANY PRODUCT. RESPONSIBILITY FOR PROPER SELECTION, USE AND MAINTENANCE OF ANY SELLER PRODUCT REMAINS SOLELY WITH THE PURCHASER AND END-USER.

DANIEL AND THE DANIEL LOGO ARE REGISTERED TRADEMARKS OF DANIEL INDUSTRIES, INC. THE ROSEMOUNT AND ROSEMOUNT ANALYTICAL LOGO THE ARE REGISTERED TRADEMARKS OF ROSEMOUNT ANALYTICAL, INC. THE EMERSON LOGO IS A TRADEMARK AND SERVICE MARK OF EMERSON ELECTRIC CO.

COPYRIGHT © 2007 BY DANIEL MEASUREMENT AND CONTROL, INC., HOUSTON, TEXAS, U.S.A.

All rights reserved. No part of this work may be reproduced or copied in any form or by any means - graphic, electronic, or mechanical — without first receiving the written permission of Daniel Measurement and Control, Inc. Houston, Texas, U.S.A.

WARRANTY

1. LIMITED WARRANTY: Subject to the limitations contained in Section 2 herein and except as otherwise expressly provided herein, Daniel Measurement and Control, Inc. and Rosemount Analytical, Inc., (collectively"Seller") warrants that the firmware will execute the programming instructions provided by Seller, and that the Goods manufactured or Services provided by Seller will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, promptly correct any errors that are found by Seller in the firmware or Services, or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by an authorized Seller representative. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller. Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller. Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES. **It is understood that corrosion or erosion of materials is not covered by our guarantee.**

2. LIMITATION OF REMEDY AND LIABILITY: SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY HEREUNDER SHALL BE LIMITED TO REPAIR, CORRECTION, REPLACEMENT OR REFUND OF PURCHASE PRICE UNDER THE LIMITED WARRANTY CLAUSE IN SECTION 1 HEREIN. IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE), SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED OR SERVICES PROVIDED BY SELLER GIVING RISE TO THE CLAIM OR CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE AND COST OF CAPITAL.

IMPORTANT INSTRUCTIONS

- Read all instructions prior to installing, operating, and servicing this product.
- Follow all warnings, cautions, and instructions marked on and supplied with this product.
- Inspect the equipment packing case and if damage exists, notify your local carrier for liability.
- Open the packing list and carefully remove equipment and spare or replacement parts from the case. Inspect all equipment for damage and missing parts.
- If items are missing, contact your local Product Services Department representative or the sales office. Provide the equipment serial number and sales order number to the Product Services Department or sales representative.

  All returned equipment or parts must have an RMA (Returned Materials Authorization) form obtained from the Products Services Department. Complete the Customer Problem Report or include a letter describing the problem and corrective action to be performed at the factory.

  Phone: 1 (713) 827-5033
- Physically attach the RMA, corrective action documentation, and a copy of the packing list to the equipment and place inside the shipping case. An envelope with a copy of the packing list may be attached to the outside of the shipping case. Send to the address shown above.
- Install equipment as specified per the installation instructions and per applicable local and national codes. All connections shall be made to proper electrical and pressure sources.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent personal injury.
- Use of this product for any purpose other than its intended purpose may result in property damage and/or serious injury or death.
- Before opening the flameproof enclosure in a flammable atmosphere, the electrical circuits must be interrupted.
- Repairs must be performed using only authorized replacement parts as specified by the manufacturer. Use of unauthorized parts can affect the product's performance and place the safe operation of the product at risk.
- When installing or servicing ATEX certified units, the ATEX approval applies only to equipment without cable glands. When mounting the flameproof enclosures in a hazardous area, only flameproof cable glands certified to IEC 60079-1 must be used.

This page is intentionally left blank.

TABLE OF CONTENTS

INTRODUCTION

1.1 DESCRIPTION OF MANUAL 1-1

1.2 SYSTEM DESCRIPTION 1-1
Analyzer Assembly 1-2
Controller Assembly 1-5
Sample Conditioning System (SCS) 1-8

1.2.1 Functional Description 1-9

1.2.2 Available Functions 1-11

1.3 SOFTWARE DESCRIPTION 1-13
BOS 1-13
MON2000 1-14

1.4 THEORY OF OPERATION 1-15

1.4.1 Thermal Conductivity Detector (TCD) 1-15

1.4.2 Flame Ionization Detector (Micro-FID) 1-18

1.4.3 LSIV 1-19

1.4.4 Methanator 1-21

1.4.5 Data Acquisition 1-22

1.4.6 Peak Detection 1-23

1.5 BASIC ANALYSIS COMPUTATIONS 1-26

1.5.1 Conc Analysis - Response Factor 1-26

1.5.2 Conc Calc - Mole Percentage (without Normalization) 1-28

1.5.3 Conc Calc in Mole Percentage (with Normalization) 1-29

1.6 ADDITIONAL RESOURCES 1-30

1.7 GLOSSARY 1-31
Auto Zero 1-31
Baseline 1-31
Carrier Gas 1-31
Chromatogram 1-31

Component 1-32
Condulet 1-32
CTS 1-32
DCD 1-32
DSR 1-32
DTR 1-32
FID 1-33
LSIV 1-33
Methanator 1-33
Response Factor 1-33
Retention Time 1-33
RI 1-34
RLSD 1-34
RTS 1-34
RxD, RD, or Sin 1-34
TCD 1-34
TxD, TD, or Sout 1-34

EQUIPMENT DESCRIPTION AND SPECIFICATIONS

2.1 EQUIPMENT DESCRIPTION 2-1
2.1.1 Upper Enclosure 2-2
2.1.2 Lower Enclosure 2-8
2.1.3 Flow Panel Assembly 2-10

2.2 EQUIPMENT SPECIFICATIONS 2-10
2.2.1 Utilities 2-10
2.2.2 Electronic Hardware 2-13
2.2.3 Micro Heat Sink Oven 2-18
2.2.4 Software 2-19

INSTALLATION AND SETUP

3.1 PRECAUTIONS AND WARNINGS 3-1
3.1.1 Hazardous Environments 3-2
3.1.2 Power Source Wiring 3-3
3.1.3 Card Cage Removal 3-4
3.1.4 Signal Wiring 3-10
3.1.5 Electrical and Signal Ground 3-11
3.1.6 Electrical Conduit 3-13
3.1.7 Sample System Requirements 3-15

Line Length: 3-15
Sample Line Tubing Material: 3-15
Dryers and Filters: 3-16
Pressure Regulators and Flow Controllers: 3-16
Pipe Threads, Dressing: 3-16
Valving: 3-16

3.2 PREPARATION 3-16

3.2.1 Site Selection 3-17

3.2.2 Unpacking the Unit 3-17

3.2.3 Model 700 Installation Arrangements 3-18
Wall Mount 3-18
Pole Mount 3-19
Floor Mount 3-19

3.2.4 Required Tools and Components 3-19

3.2.5 Supporting Tools and Components 3-21

3.3 MODEL 700 INSTALLATION 3-23

3.3.1 DC Power Supply 3-23

3.3.2 Optional AC – DC Power Converter 3-25

3.3.3 Sample and Gas Lines 3-28

3.4 SETTING THE COM ID 3-33

3.4.1 Inspect or Change the Com ID 3-33

3.4.2 Preparing for Serial Connections 3-37

3.4.3 FTB Connection (RS-232) 3-40

3.4.4 PC to GC Cable Short Distance Connection (RS-232) 3-41

3.4.5 Long Distance Connection (RS-422, RS-485) .. 3-47

3.4.6 GC-Printer Wiring 3-49

3.4.7 Discrete Digital I/O Wiring 3-50
Discrete Digital Inputs 3-50
Discrete Digital Outputs 3-51

3.4.8 Analog Input Wiring 3-53

3.4.9 Analog Output Wiring 3-54

3.4.10 Optional Boards 3-56
Optional WinSystems Modem 3-56
Optional Radicom Modem Settings 3-57
Ethernet Settings 3-58

3.5 LEAK CHECKS AND PURGING FOR FIRST CALIBRATION 3-59

3.5.1 Initial Leak Check 3-59
Carrier Gas Line Leak Checks 3-59
Calibration Line Leak Check 3-60
Sample Lines (Streams) Leak Check 3-61

3.5.2 Purging Carrier Gas Lines 3-61

3.5.3 Purging Calibration Gas Lines 3-63

3.6 SYSTEM STARTUP 3-64

MAINTENANCE AND TROUBLESHOOTING

4.1 HAZARDOUS ENVIRONMENTS 4-1

4.2 TROUBLESHOOTING AND REPAIR CONCEPT ... 4-2

4.3 ROUTINE MAINTENANCE 4-2

4.3.1 Bimonthly Maintenance Checklist 4-3

4.3.2 Routine Maintenance Procedures 4-5

4.3.3 Contact Service 4-5

4.4 ACCESS TO GC EQUIPMENT ELEMENTS 4-6

4.4.1 Electrical/Electronic Components 4-6
Model 700 with TCD Upper Enclosure 4-7
Model 700 with TCD Lower Enclosure 4-7
Model 700 with Micro-FID/TCD Upper Enclosure 4-7
Model 700 with Micro-FID/TCD Lower Enclosure 4-7

4.4.2 Detector Elements, Heater Elements, Valves and Columns 4-8

4.5 PRECAUTIONS FOR HANDLING PC ASSEMBLIES 4-12

4.6 GENERAL TROUBLESHOOTING 4-13

4.6.1 Hardware Alarms 4-13

4.6.2 Troubleshooting Checklist 4-15
4.6.3 Test Points Dual Methods Board and FTB 4-20
4.6.4 Preamplifier 4-22
4.6.5 Flow Balance Check 4-22
4.6.6 Temperature 4-22
4.6.7 FID Configuration 4-25
Baseline Drift 4-26

4.7 LEAK CHECKS 4-27
4.7.1 Field Service 4-27
4.7.2 Factory Level Leak Check 4-28
4.7.3 Plugged Lines, Columns, or Valves 4-31

4.8 CHROMATOGRAPH VALVES 4-31
4.8.1 Required Tools 4-31
4.8.2 Chromatograph Valve Replacement Parts 4-32
4.8.3 Valve Cleaning 4-32
4.8.4 TCD Oven System Removal 4-33
4.8.5 Micro-FID Removal 4-36
4.8.6 Micro-FID Maintenance 4-39
4.8.7 Micro-FID Re-assembly 4-39
4.8.8 LSIV Maintenance 4-41
4.8.9 LSIV Removal 4-41
Replacing LSIV Seals 4-42
LSIV Disassembly 4-43
4.8.10 Methanator Maintenance 4-45
4.8.11 Valve Overhaul 4-46
4.8.12 Oven System and Stream Switching System Solenoid Valve Replacement 4-48
4.8.13 Solenoid Valve Replacement 4-49

4.9 TCD DETECTOR BRIDGE BALANCE 4-52

4.10 MEASURE VENT FLOW 4-55

4.11 MODEL 700 ELECTRICAL COMPONENTS 4-56

4.11.1 DC Power Supply Replacement Procedures..... 4-59

4.12 COMMUNICATIONS 4-61
Model 700 GC with the TCD 4-61
Model 700 GC with the Micro-FID/TCD..... 4-61

4.13 ANALOG INPUTS/OUTPUTS 4-65

4.13.1 Model 700 Analog Inputs 4-66

4.13.2 Analog Output Adjustment 4-67

4.13.3 Model 700 Analog Outputs 4-68
Standard Analog Outputs 4-68

4.14 DISCRETE DIGITAL INPUTS/OUTPUTS 4-70

4.15 RECOMMENDED SPARE PARTS..... 4-70

4.16 UPGRADE PROCEDURES 4-71

4.16.1 Base Operating System..... 4-71

4.16.2 Applications 4-71

APPENDIX A, COMMUNICATIONS SPECIFICATIONS

A.1 TCD SERIAL COMMUNICATIONS.....A-1

A.1.1 Model 700 with a TCD Comm Ports A-2

A.2 FID SERIAL COMMUNICATIONS A-7

A.2.1 Connecting Serial Communications to the GC .A-10
RS-232 Ports.....A-11
RS-422 Ports.....A-11
RS-485 Serial Specifications.....A-11

A.2.2 FTB Serial Communications A-12
WinSystems CPU A-15
WinSystems MCM/LPM – Com4A Board.....A-19
Com4A Board Compatibility Settings A-23
WinSystems Ethernet Board A-24
Radicom 56K Baud Modem Board A-25

A.3 WIRING LOCAL RS-232 COMMUNICATIONS..A-25

A.3.1 GC Serial Port and Cable Configurations.....A-25

A.3.2 GC DB 9-pin Serial Port to PC DB 9-pin Port ...A-29
A.3.3 GC DB 9-pin Serial Port to PC DB 25-pin Port .A-30
A.3.4 GC PHOENIX Plug Port to PC DB 9-pin Port A-31
A.3.5 GC PHOENIX Plug Port to PC DB 25-pin Port ..A-32

A.4 WIRING REMOTE RS-232 COMMUNICATIONS A-33

A.4.1 GC DB 9-pin Serial Port to Modem DB 25-pin Port A-33
A.4.2 GC PHOENIX Plug to Modem DB 25-pin Port ..A-34

A.5 EXAMPLE RS-422 PC-GC CONNECTION A-35

A.6 EXAMPLE RS-485 PC-GC CONNECTION A-37

APPENDIX B, MODEM INSTALLATION

B.1 OPTIONAL INTERNAL MODEM B-1

B.1.1 Optional Ethernet Board B-3

APPENDIX C, MANIFOLD CARRIER FOR GAS BOTTLES

C.1 CARRIER GAS C-1

C.2 INSTALLATION AND LINE PURGING.....C-2

C.3 REPLACING CARRIER CYLINDER.....C-3

C.4 CALIBRATION GAS C-4

APPENDIX D, ENGINEERING DRAWINGS

D.1 LIST OF ENGINEERING DRAWINGS D-1

APPENDIX E, LOCAL OPERATOR INTERFACE

E.1 INTERFACE COMPONENTS FOR DISPLAYING AND ENTERING DATA E-1

E.1.1 Light Emitting Diode Indicators.....E-1
E.1.2 LCD Screen E-2
E.1.3 Keypad E-2
E.1.4 Security Switch E-3

E.2 USING THE LOCAL OPERATOR INTERFACE E-3

E.2.1 Navigating the Screen E-4
E.2.2 Editing Numeric Data E-5
E.2.3 Editing Non-Numeric Data E-6

E.3 NAVIGATING THE LOI MENUS E-9

E.3.1 The Ctrl Menu E-11
E.3.2 The App Menu E-17
E.3.3 The Chrom Menu E-27
E.3.4 The Logs Menu E-34
E.3.5 The Manage Menu E-45

LIST OF FIGURES

Figure 1-1 Block Diagram Upper Enclosure with TCD 1-3
Figure 1-2 Block Diagram Upper Enclosure with Micro-FID 1-4
Figure 1-3 Block Diagram TCD Lower Enclosure 1-6
Figure 1-4 Block Diagram Micro-FID Lower Enclosure 1-7
Figure 1-5 Analyzer Assembly with TCD Detector Bridge 1-16
Figure 1-6 Detector Output During Component Elution 1-17
Figure 1-7 Analyzer Assembly with Micro-FID Detector Bridge 1-18
Figure 1-8 Model 700 LSIV Assembly 1-19
Figure 1-9 Model 700 Methanator Assembly 1-21
Figure 2-1 Model 700 Gas Chromatograph 2-1
Figure 2-2 Upper Enclosure Assembly 2-2
Figure 2-3 TCD Oven System Assembly 2-3
Figure 2-4 Model 700 Micro-FID Upper Assembly 2-4
Figure 2-5 Model 700 Methanator Upper Assembly 2-5
Figure 2-6 LSIV Assembly 2-6
Figure 2-7 SSS Installed 2-7
Figure 2-8 Lower Enclosure Assembly 2-8
Figure 2-9 Upper Electronics with TCD Block Diagram 2-13
Figure 2-10 Upper Electronics with Micro-FID Block Diagram 2-14
Figure 2-11 Lower Electronics TCD Block Diagram 2-15
Figure 2-12 Lower Electronics Micro-FID Block Diagram 2-16
Figure 3-1 Lower Enclosure Disassembly 3-5
Figure 3-2 Card Cage Cable Disassembly 3-6
Figure 3-3 Card Cage Assembly Screw Locations 3-7
Figure 3-4 Card Cage Disassembly 3-8
Figure 3-5 Card Cage Disassembly for Power and Signal Wiring 3-9
Figure 3-6 Ground Lug Lower Enclosure 3-12
Figure 3-7 Stream Inlets (Right side of unit) 3-15

Figure 3-8 24 VDC Power Connection 3-24
Figure 3-9 24 VDC Power Inlet 3-24
Figure 3-10 AC/DC Power Converter 3-26
Figure 3-11 Model 700 Upper Enclosure 3-28
Figure 3-12 Carrier Gas Inlet Left-side Upper Enclosure 3-29
Figure 3-13 Calibration Gas Stream Inlet (Right side of unit) 3-31
Figure 3-14 Sample Stream Inlets (Right side of unit) 3-32
Figure 3-15 Dip Switch 3-33
Figure 3-16 Oven Mounting Bracket 3-34
Figure 3-17 Multifunction Board Location 3-35
Figure 3-18 Dip Switch 3-35
Figure 3-19 Field Termination Board 3-41
Figure 3-20 Configuration without Com4A Board 3-42
Figure 3-21 Configuration with Com4A Board 3-42
Figure 3-22 FTB Com1 and Com2 DB 9-pin Connector 3-43
Figure 3-23 FTB Com 1 DB 9-pin Phoenix Connector 3-44
Figure 3-24 FTB Com2 DB 9-pin Phoenix Connector 3-44
Figure 3-25 FTB Com5 DB 9-pin Phoenix Connector 3-45
Figure 3-26 FTB Com6 DB 9-pin Phoenix Connector 3-45
Figure 3-27 FTB Com7 DB 9-pin Phoenix Connector 3-46
Figure 3-28 Com8 DB 9-pin Phoenix Connector GC Phoenix Plug Port 3-46
Figure 3-29 GC Phoenix Plug Port to External Modem DB 25-pin Port 3-47
Figure 3-30 Field Termination Board 3-50
Figure 4-1 Model 700 with TCD/Micro-FID Front View 4-6
Figure 4-2 CPU, Com4A, and Modem Boards 4-8
Figure 4-3 Upper Explosion-proof Housing 4-9
Figure 4-4 Thermal Conductivity Detector 4-10
Figure 4-5 Flame Ionization Detector 4-10
Figure 4-6 Test Points Dual Methods Board (Cut View) 4-20
Figure 4-7 Test Points Dual Methods Board 4-20
Figure 4-8 Test Points Field Termination Board (Cut View) 4-21

Figure 4-9 Test Points Field Termination Board 4-21
Figure 4-10 Temperature Control Dialog 4-23
Figure 4-11 Chromatograph Valve Assemblies 4-32
Figure 4-12 Micro-FID Oven System Thermal Cover 4-33
Figure 4-13 TCD Upper Assembly Components 4-34
Figure 4-14 TCD Oven System Disassembly 4-35
Figure 4-15 Micro-FID Upper Assembly Components 4-37
Figure 4-16 Model 700 with Micro-FID Upper Assembly 4-38
Figure 4-17 Upper Enclosure Thermal Cover 4-40
Figure 4-18 Model 700 with LSIV 4-43
Figure 4-19 Model 700 Optional Methanator Assembly 4-45
Figure 4-20 TCD Valve Tubing and Fittings 4-47
Figure 4-21 Side View TCD Oven System Mounting Bracket 4-49
Figure 4-22 Rotated TCD Upper Assembly 4-50
Figure 4-23 Stream Switching Assembly 4-51
Figure 4-24 Stream Switching System Final Assembly 4-52
Figure 4-25 Model 700 Micro-FID/TCD Preamplifier 4-53
Figure 4-26 Model 700 TCD Bridge Balance 4-54
Figure 4-27 Model 700 Micro-FID Bridge Balance 4-54
Figure 4-28 Measure Flow Vents 4-55
Figure 4-29 Model 700 Lower Enclosure 4-57
Figure 4-30 Model 700 Card Stack Assembly 4-57
Figure 4-31 Model 700 Lower Assembly 4-58
Figure 4-32 DC Power Supply Lower Enclosure 4-59
Figure 4-33 Dip Switch 4-62
Figure 4-34 Multifunction Board 4-63
Figure 4-35 Analog Board - Inputs 4-66
Figure 4-36 Analog Inputs 4-67
Figure 4-37 FTB Board Analog Outputs 4-68
Figure 4-38 Analog Outputs 4-69

Figure 4-39 Optional Analog Board Outputs 4-69
Figure A-1 Standard Configuration without LOI and Com4A Board A-3
Figure A-2 Configuration with LOI A-3
Figure A-3 Configuration with Com4A Board A-4
Figure A-4 Configuration with Com4A Board and LOI A-5
Figure A-5 FTB Com1 and Com2 DB9 Connector A-6
Figure A-6 Configuration without Com4A Board A-8
Figure A-7 Configuration with Com4A Board A-9
Figure A-8 FTB Com1 DB 9-pin Phoenix Connector A-12
Figure A-9 FTB Com2 DB 9-pin Phoenix Connector A-12
Figure A-10 FTB Com5 DB 9-pin Phoenix Connector A-13
Figure A-11 FTB Com6 DB 9-pin Phoenix Connector A-13
Figure A-12 FTB Com7 DB 9-pin Phoenix Connector A-14
Figure A-13 FTB Com8 DB 9-pin Phoenix Connector A-14
Figure A-14 FTB Serial Connections A-26
Figure A-15 FTB Serial Connections A-26
Figure A-16 Phoenix Connector (J5, J6, J10, and J11) Pinout A-27
Figure A-17 DB 9-pin Connector (P2 and P3) and Pinout for Jacks A-28
Figure A-18 GC DB 9-pin Port to PC DB 9-pin Port A-29
Figure A-19 GC DB 9-pin Port to PC DB 25-pin Port A-30
Figure A-20 GC DB 9-pin Port to PC DB 25-pin Port A-31
Figure A-21 GC Phoenix Plug Port to PC DB 25-pin Port A-32
Figure A-22 GC DB 9-pin Port to External Modem DB 25-pin Port A-33
Figure A-23 GC Phoenix Plug Port to External Modem DB 25-pin Port A-34
Figure A-24 Example RS-422 Serial Cable Terminations A-35
Figure A-25 Example RS-485 Serial Cable Terminations, Line Driver to GC Controller Com3 ..... A-37
Figure A-26 Example RS-485 Serial Cable Terminations, Line Driver to GC Controller Com4 ..... A-38
Figure B-1 Radicom 56K Baud Modem Installation B-2

Figure C-1 Manifold for Two Carrier Gas Bottles to GC System C-1
Figure E-1 LOI Unit with Interface Components Listed E-1

This page is intentionally left blank.

LIST OF TABLES

Table 2-1 Model 700 Unit Specifications 2-11
Table 2-2 Electronic Hardware Specification 2-17
Table 2-3 Oven Assembly Specifications 2-18
Table 2-4 Software Specifications 2-19
Table 3-1 Flamepath Fitting Tube Gap Safety 3-2
Table 3-2 DC Power Wiring 3-25
Table 3-3 AC Wiring 3-27
Table 3-4 Modbus Slave Address (Com ID) DIP Switch Settings 3-36
Table 3-5 Switch Positions for Cold Start 3-36
Table 3-6 FTB Discrete Digital Inputs 3-51
Table 3-7 FTB Discrete Digital Outputs 3-52
Table 3-8 FTB Analog Inputs 3-53
Table 3-9 FTB Analog Outputs 3-54
Table 3-10 Optional Analog Outputs 3-55
Table 3-11 J8 Modem Board Jumper Settings 3-56
Table 3-12 J9 Modem Board Jumper Settings 3-56
Table 3-13 J10 Modem Board Jumper Settings 3-56
Table 3-14 J26 Radicom Modem Jumper Settings 3-57
Table 3-15 J27Radicom Modem Jumper Settings 3-57
Table 3-16 J30 Radicom Modem Jumper Settings 3-57
Table 3-17 J31 Radicom Modem Jumper Settings 3-57
Table 3-18 J1 PCM-NE2000 Ethernet Board Jumper Settings 3-58
Table 3-19 J2 PCM-NE2000 Ethernet Board Jumper Settings 3-58
Table 3-20 J3 PCM-NE2000 Ethernet Board Jumper Settings 3-58
Table 4-1 Flamepath Fitting Tube Gap Safety 4-1
Table 4-2 Maintenance Checklist 4-4
Table 4-3 Basic Hardware Troubleshooting via Alarms 4-13
Table 4-4 Troubleshooting Checklist 4-17

Table 4-5 Temperature Control Dialog 4-24
Table A-1 Matrix of Possible TCD Configurations Field Termination Board A-1
Table A-2 Matrix of Possible FID Configurations Field Termination Board A-7
Table A-3 Communication with WinSystems CPU A-15
Table A-4 Communication with WinSystems CPU A-16
Table A-5 Communication with WinSystems CPU A-17
Table A-6 Communication with WinSystems CPU A-18
Table A-7 Communication with WinSystems MCM/LPM – Com4A Board (Optional) A-19
Table A-8 J10 Jumper Settings A-23
Table A-9 J7 Jumper Settings A-23
Table A-10 J8 Jumper Settings A-23
Table A-11 J9 Jumper Settings A-23
Table A-12 Ethernet Board Pin Settings A-24
Table A-13 J26 Radicom Modem Jumper Settings A-25
Table A-14 J27 Radicom Modem Jumper Settings A-25
Table A-15 J30 Radicom Modem Jumper Settings A-25
Table A-16 J31 Radicom Modem Jumper Settings A-25
Table A-17 Serial Ports on Field Termination Board A-27
Table A-18 Switch Settings for LD485A-MP, RS-422 to GC A-36
Table A-19 Jumper Settings for LD485A-MP, RS-422 to GC A-36
Table A-20 Switch Settings for LD485A-MP, RS-485 to GC A-39
Table A-21 Jumper Settings for LD485A-MP, RS-485 to GC A-39
Table C-1 Contents of Example Calibration Gas C-4
Table E-1 GC Conditions Indicated by the LEDs E-2
Table E-2 Status Display Mode Screens in Order of Appearance E-3
Table E-3 List of Submenus and Commands E-10
Table E-4 Operational Modes for Valves E-26
Table E-5 Scaling Values Defintions E-29
Table E-6 Definition of Archived Chromatogram Screen Options E-33

INTRODUCTION

This section describes the contents and purpose of the Model 700 *Gas Chromatograph System Reference Manual*, a description of the Model 700 system, an explanation of the theory of operation, and a glossary of chromatograph terminology.

Use this section to get acquainted with the basic engineering of the Model 700 product.

1.1 DESCRIPTION OF MANUAL

The Model 700 *Gas Chromatograph System Reference Manual* (P/N 3-9000-521) consists of Installation, Operations, and Maintenance and Troubleshooting Procedures. Also, included is information about the MON2000 software interface.

1.2 SYSTEM DESCRIPTION

The Model 700 is a high-speed gas chromatograph (GC) system that is engineered to meet specific field application requirements based on typical natural gas stream composition and anticipated concentration of the selected components. In its standard configuration, the Model 700 can handle up to four streams: typically, three for sample and one for calibration.

The Model 700 system consists of three major parts: the Analyzer Assembly, Controller Assembly, and Sample Conditioning System (SCS).

Model 700 subsystems are: a Flame Ionization Detector (Micro-FID), a Liquid Sample Injector (LSIV) and a Methanator.

Analyzer Assembly

The Analyzer Assembly (upper enclosure) includes columns TCD/Micro-FID detectors, Methanator, preamplifier, preamplifier power supply, stream switching valves, and solenoids. See Figure 1-2 Block Diagram Upper Enclosure for TCD details and Figure 1-5 Block Diagram Upper Enclosure for Micro-FID details. Additionally, the Model 700 may be equipped with the Liquid Sample Inject Valve (LSIV) or a Methantor.

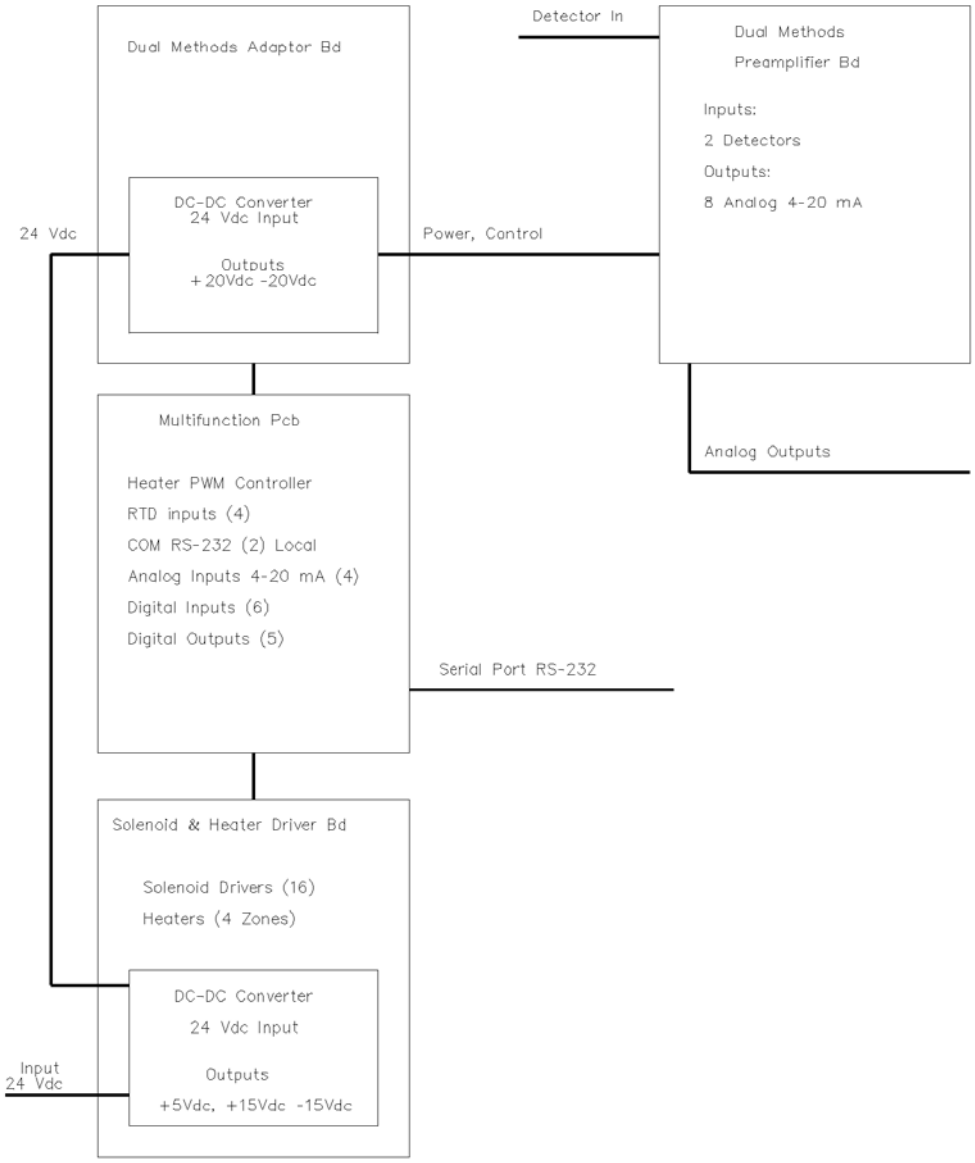


Figure 1-1 Block Diagram Upper Enclosure with TCD

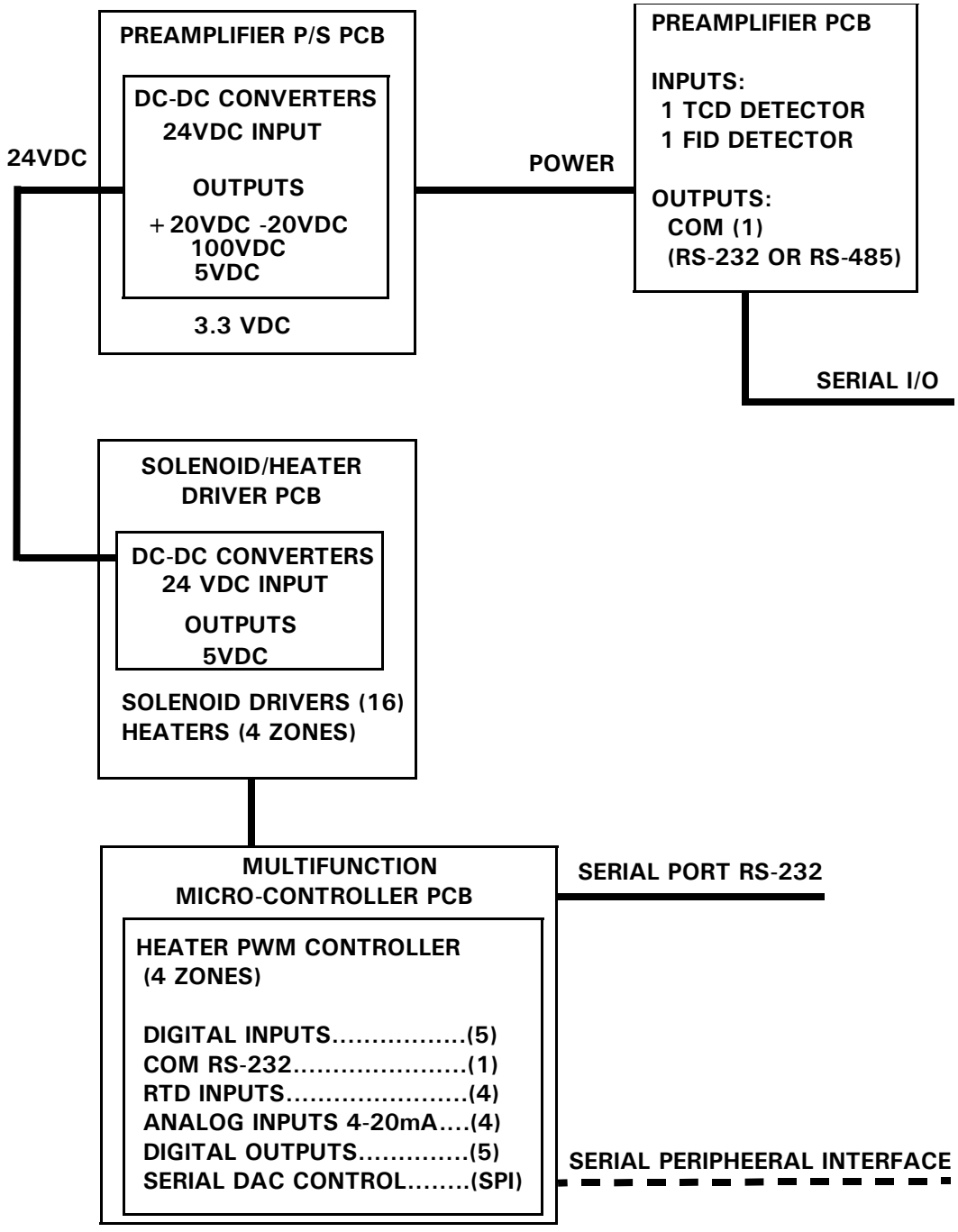


Figure 1-2 Block Diagram Upper Enclosure with Micro-FID

Controller Assembly

The Controller Assembly (lower enclosure) includes electronics and ports for signal processing, instrument control, data storage, personal computer (PC) interface, and telecommunications. This assembly allows the user to control the GC functions via a PC with the MON2000 software package (see Section 1.3).

See Figure 1-3 and Figure 1-4 for lower enclosure block diagrams.

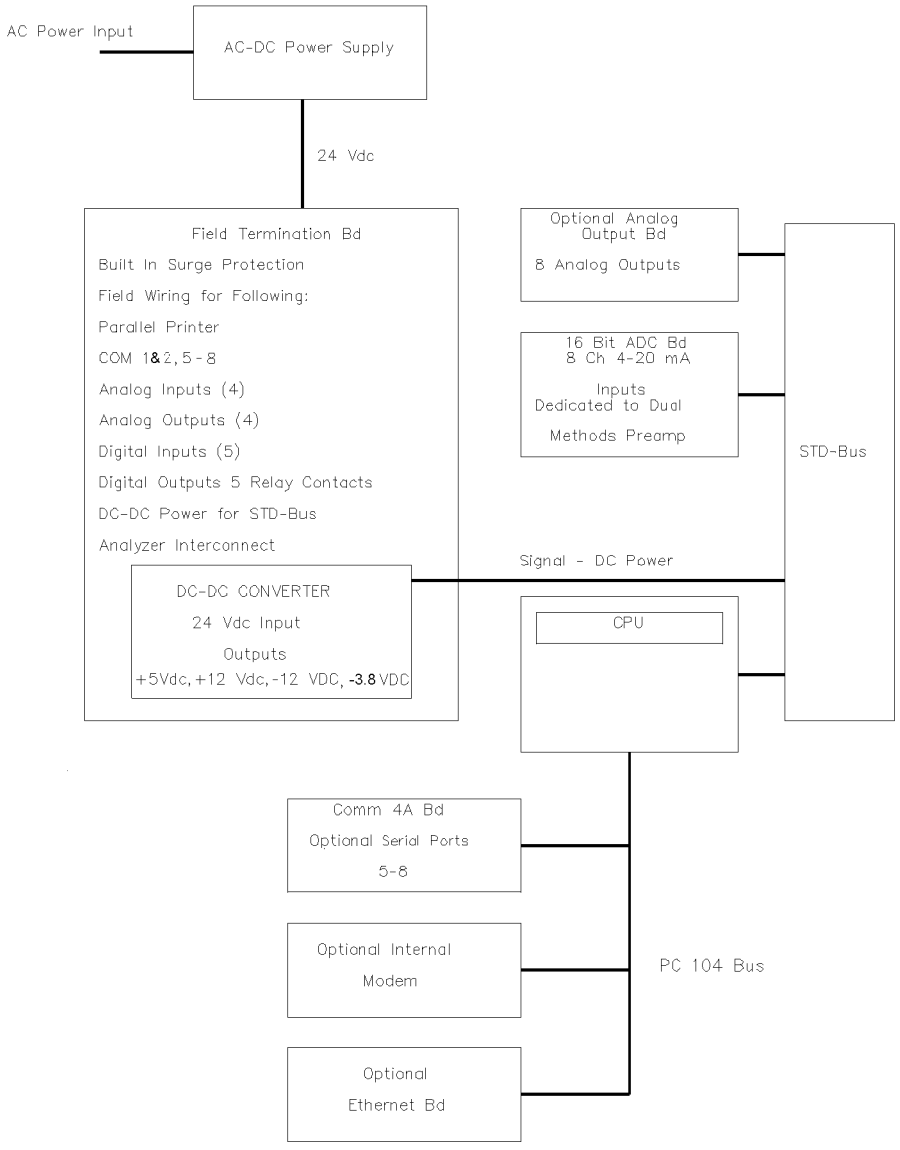


Figure 1-3 Block Diagram TCD Lower Enclosure

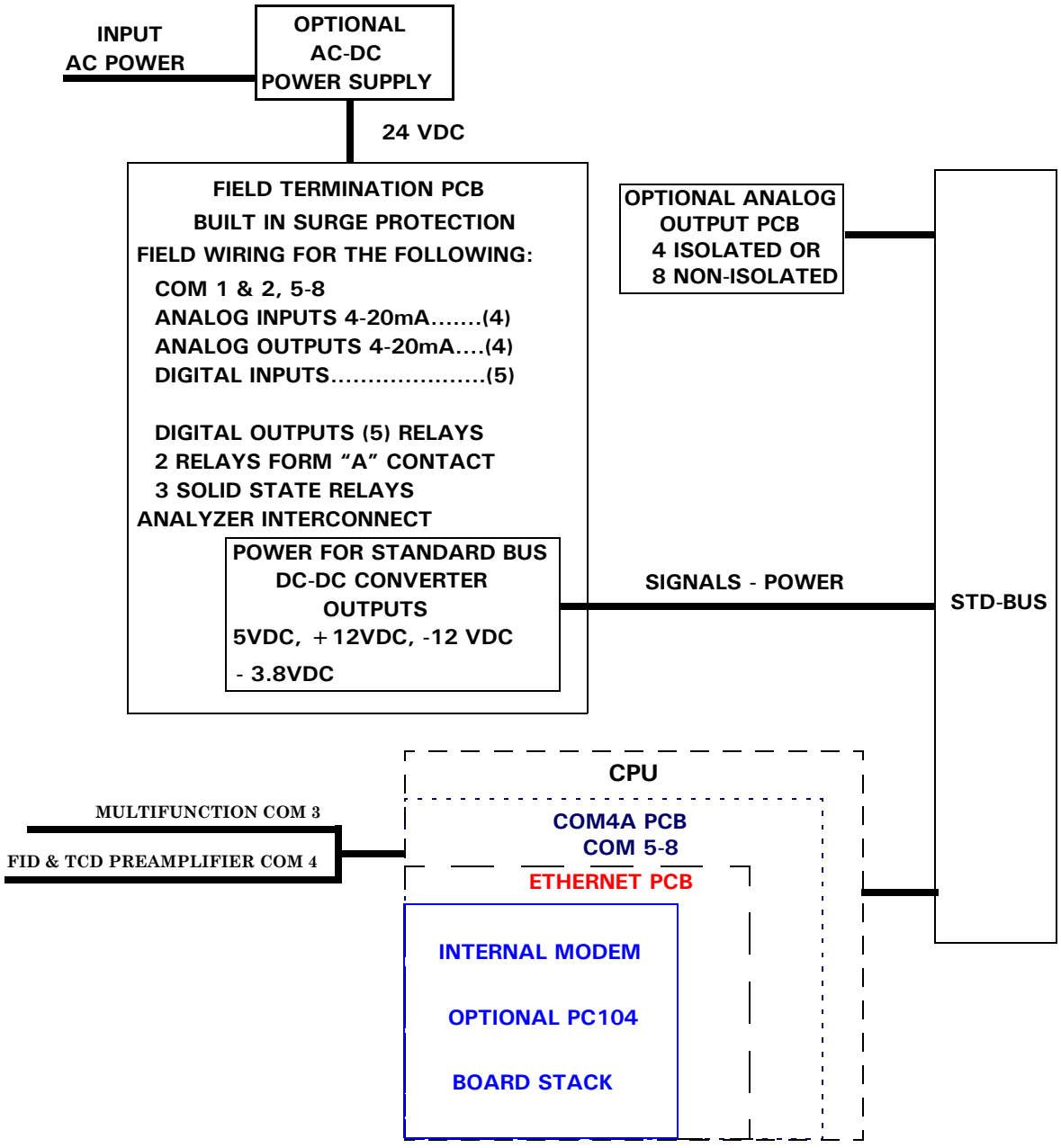


Figure 1-4 Block Diagram Micro-FID Lower Enclosure

The GC-PC interface provides the user with the greatest capability, ease-of-use, and flexibility. One PC running MON 2000 can connect with up to 32 chromatographs (via RS-485 serial communications links). MON 2000 is used to edit applications, monitor operations, calibrate streams, and display analysis chromatograms and reports, which can then be stored to files on the PC hard drive or printed from either the PC printer port or the GC printer port.

Sample Conditioning System (SCS)

The sample conditioning system is located between the process stream and the Analyzer Assembly sample inlet (mounted on the lower portion of the Analyzer Assembly stand). The standard configuration includes a Stream Switching System and filters.

The Model 700 electronics and hardware are housed in two explosion-proof enclosures and meet IEC Class I, Zone 1, Ex d IIB+H_2, T4 (NEC Class 1, Division 1, Groups B, C, and D) approval for use in a hazardous environment.

1.2.1 Functional Description

A sample of the gas to be analyzed is taken from the process stream by a sample probe installed in the process line. The sample passes through a sample line to the SCS where it is filtered or otherwise conditioned. After conditioning, the sample flows to the Analyzer Assembly for separation and detection of the gas components.

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Do not use a PC or a printer in a hazardous area. Serial port and Modbus communications links are provided to connect the unit to the PC and to connect to other computers and printers in a safe area.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

The chromatographic separation of the sample gas into its components is accomplished in the following manner. A precise volume of sample gas is injected into one of the analytical columns. The column contains a stationary phase (packing) that is either an active solid or an inert solid support that is coated with a liquid phase (absorption partitioning). The sample gas is moved through the column by means of a mobile phase (carrier gas). The selective retardation of the components takes place in the column, causing each component to move through the column at a different rate. This separates the sample into its constituent gases and vapors.

NOTICE

For additional information,
see Section 1.4

A detector located at the outlet of the analytical column senses the elution of components from the column and produces electrical outputs proportional to the concentration of each component. Outputs from the detector(s) are amplified in the Analyzer Assembly electronics, then transmitted to the Controller Assembly for further processing.

Output from the Controller Assembly is normally displayed on a remotely located PC or a printer. Connection between the Controller Assembly and the PC can be accomplished via a direct serial line or via a Modbus-compatible communication interface.

Several chromatograms may be displayed via MON2000, with separate color schemes, allowing the user to compare present and past data.

Use of the MON2000 software for configuration and troubleshooting procedures is essential in most cases. The PC may be remotely connected via telephone, radio or satellite communications. Once installed and configured, the Model 700 can operate independently for long periods of time.

1.2.2 Available Functions

Individual GC functions that can be initiated or controlled by the GC system and its software, MON2000, include (but are not limited to) the following:

- valve activations
- timing adjustments
- stream sequences
- calibrations
- baseline runs
- analyses
- halt operation
- stream/detector assignments
- stream/component table assignments
- stream/calculation assignments
- diagnostics
- alarm and event processing
- event sequence changes
- component table adjustments
- calculation adjustments
- alarm parameters adjustments
- analog scale adjustments

Reports and logs that can be produced, depending upon the GC application in use, include (but are not limited to) the following:

- Configuration Report
- Parameter List
- Analysis Chromatogram
- Chromatogram Comparison
- Alarm Log (unacknowledged and active alarms)
- Event Log
- Various Analysis Reports

1.3 SOFTWARE DESCRIPTION

The MON2000 uses three distinct types of software. This enables total flexibility in defining the calculation sequence, printed report content, format, type and amount of data for viewing, control and/or transmission to another computer or Controller Assembly. The three types are:

- Baseline Operating System (BOS)
- Application configuration software
- Maintenance and Operations software (MON2000 version 2.2 or later)

The BOS and the Application configuration software are installed when the Model 700 system is shipped. The application configuration is tailored to the customer's process and shipped on a floppy disk. Note that the hardware and software are tested together as a unit before the equipment leaves the factory. The MON2000 software program communicates with the Model 700 system and allows an initial site system setup (i.e., operational parameters, application modifications, and maintenance).

BOS

The Baseline Operating System (BOS) supervises operation of the Model 700 through its internal microprocessor-based controller; all direct hardware interface is via this control software. It consists of a multi-tasking program that controls separate tasks in system operation, as well as hardware self-testing, user application downloading, start-up, and communications. Once configured, a Model 700 can operate as a stand alone unit.

MON2000

MON2000, available as a Windows-based program, provides the human-machine interface for maintenance, operation, and troubleshooting. It allows the user to download applications developed for a specific GC unit. MON2000 provides operator control of the connected Model 700, monitors analysis results, and inspects and edits various parameters that affect Model 700 operation. It also controls display and printout of the chromatograms and reports, and it stops and starts automatic analysis cycling or calibration runs.

After the equipment/software has been installed and the operation stabilized, automatic operation can be initiated. The link between the MON2000 computer and the Model 700 can either be direct, via a local serial connection or remote, via an ethernet network, modems, telephone lines and/or radio.

Operation of multiple Model 700 chromatographs (up to 32) with a single MON2000 computer, via a multi-drop serial link, is also supported.

NOTICE

See Section 1.7 for definitions of the terminology used in the following explanations.

1.4 THEORY OF OPERATION

The following sections discuss the theory of operation for the Model 700, the engineering principles and concepts used.

1.4.1 Thermal Conductivity Detector (TCD)

One of the detectors (located on the oven in the Analyzer upper assembly) is a thermal conductivity detector that consists of a balanced bridge network with heat sensitive thermistors in each leg of the bridge. Each thermistor is enclosed in a separate chamber of the detector block.

One thermistor is designated the reference element and the other the measurement element. See Figure 1-5 for a schematic diagram of the thermal conductivity detector (TCD).

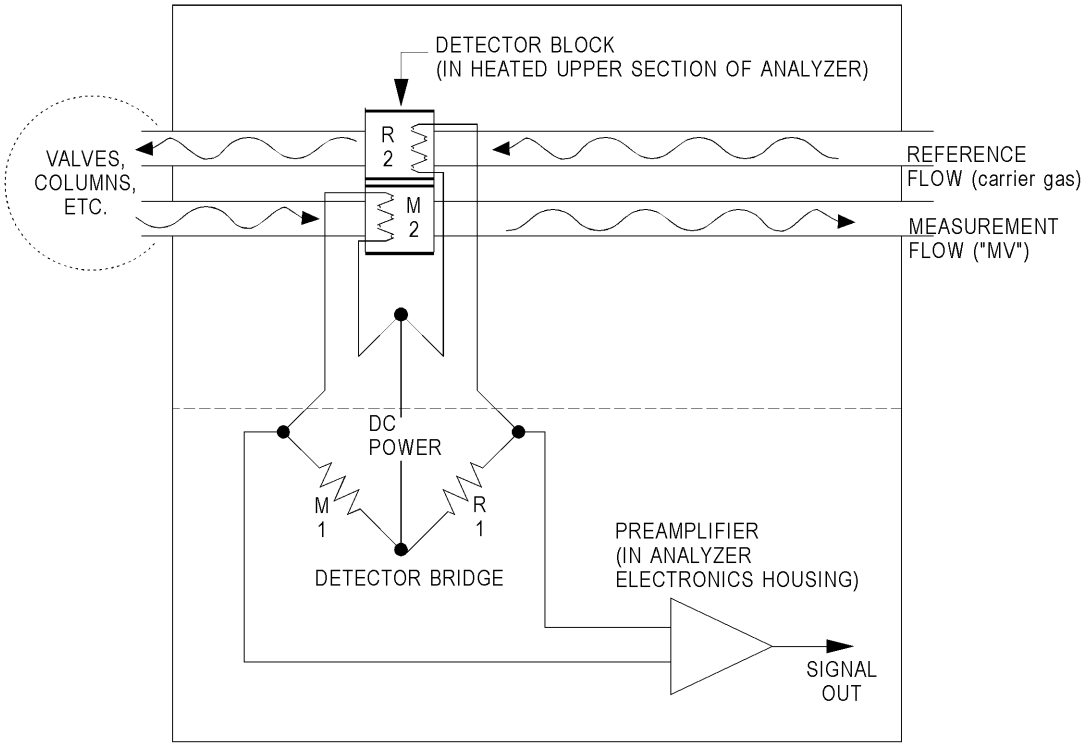


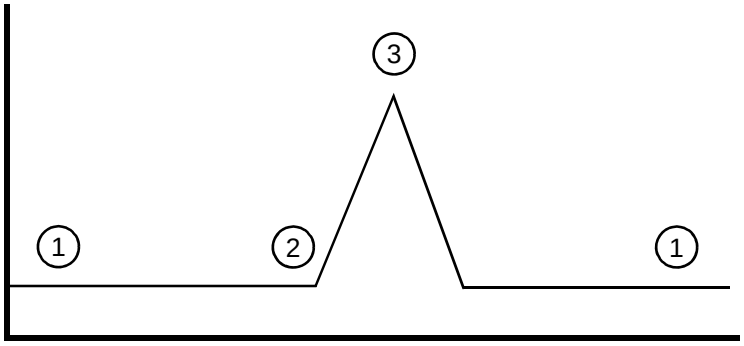
Figure 1-5 Analyzer Assembly with TCD Detector Bridge

In the quiescent condition (prior to injecting a sample), both legs of the bridge are exposed to pure carrier gas. In this condition, the bridge is balanced and the bridge output is electrically nulled. (The bridge can be balanced by the fine and coarse adjustment potentiometers located on the preamplifier circuit board.)

The analysis begins when a fixed volume of sample is injected into the column by operation of the sample valve. The sample is moved through the column by the continuous flow of carrier gas. As successive components elute from the column, the temperature of the measurement element changes.

The temperature change unbalances the bridge and produces an electrical output proportional to the component concentration.

The differential signal developed between the two thermistors is amplified by the preamplifier. Figure 1-6 illustrates the change in detector electrical output during elution of a component.



1 detector bridge balanced

2 component begins to elute from column and is measured by thermistor

3 peak concentration of component

Figure 1-6 Detector Output During Component Elution

In addition to amplifying the differential signal developed between the two thermistors, the preamplifier supplies drive current to the detector bridge. The voltage signal is converted to a 4-20 milliampere (mA) current loop for transmission to the Controller Assembly.

The signal is proportional to the concentration of a component detected in the gas sample. The preamplifier provides four different gain channels as well as compensation for baseline drift.

The signals from the preamplifier are sent to the Controller Assembly for computation, recording on a printer, or viewing on a PC monitor (via MON2000).

1.4.2 Flame Ionization Detector (Micro-FID)

The other detector (located on the oven in the Analyzer Assembly) is a Flame Ionization Detector. The Micro-FID requires a polarization voltage and its output is connected to the input to a high impedance amplifier which is called an Electrometer. The burner uses a mixture of hydrogen and air to maintain the flame. The sample of gas to be measured is also injected into the burner. See Figure 1-7 for a schematic diagram of the Flame Ionization Detector (Micro-FID).

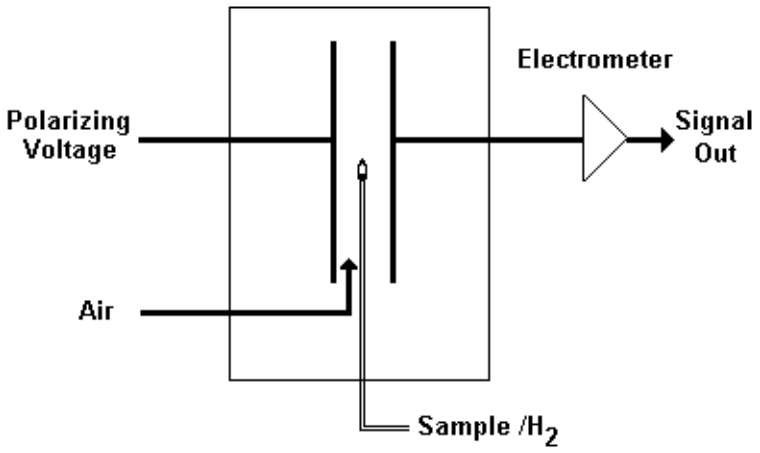


Figure 1-7 Analyzer Assembly with Micro-FID Detector Bridge

1.4.3 LSIV

The Liquid Sample Inject Valve (LSIV) penetrates the wall of the upper enclosure and is held in place by a retaining ring. The mounting arrangement is designed to ensure integrity of the flameproof enclosure.

Model 700 LSIV Upper Enclosure

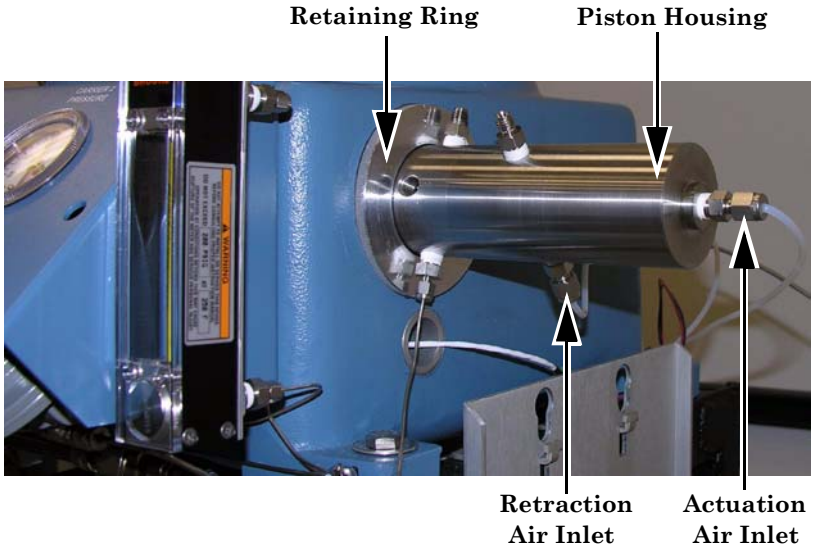


Figure 1-8 Model 700 LSIV Assembly

The outermost end houses an air operated piston. Air at 15 to 45 psi is directed by a solenoid valve to either advance the stem to inject the sample or to retract the stem.

The next section houses an auxiliary stem seal assist. A piston driven by air at 80 to 100 psi keeps adequate load on the stem seal to counteract wear at the high temperatures and pressures that might be encountered. There are two ¼"npt ports in this section; one port retracts the sample piston and the other port activates the seal assist.

The innermost section houses the stem seals and the sample chamber. There are five ¼" npt ports in this section.

Within the enclosure cavity are the flash chamber components surrounded with insulating covers. At working temperatures, the surfaces of these covers become very hot to the touch.

The tip of the LSIV is the port where flashed sample is taken to the oven system.

The port at right angles to the length of the LSIV is the input for carrier gas.

The heater block, a cylinder of aluminum, is installed off-center surrounding the flash chamber, close to the wall of the upper enclosure. It houses the heater and an RTD and is retained by a jamb nut that should only be finger tight.

1.4.4 Methanator

After all other components have been separated from the sample, normally undetectable CO and CO_2 are sent through the methanator. They are combined with hydrogen to make methane in a heat generated catalytic reaction. The methanator is also known as a methanizer or a catalytic converter.

Model 700 Methanator Upper Enclosure

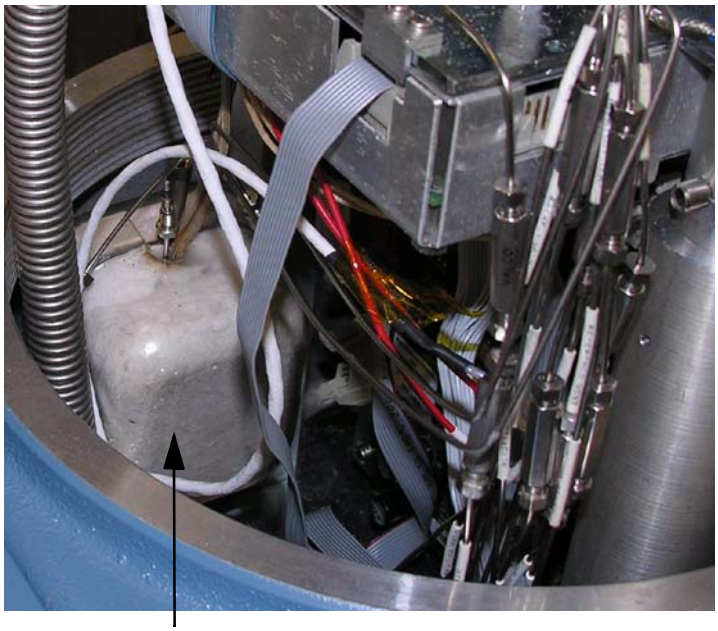


Figure 1-9 Model 700 Methanator Assembly

1.4.5 Data Acquisition

Every second, exactly 40 equi-spaced data samples are taken (i.e., one data sample every 25 milliseconds) for analysis by the Controller Assembly. The sampling frequency of 40 Hertz (Hz) was chosen to reduce normal mode noise (at 60 Hz).

After each point on the chromatograph signal is sampled, the resulting number is stored for processing in a buffer area of the Controller Assembly memory. During the analysis, only the last 256 data points are available for processing.

Because the data analysis is done as the signal is sampled (in real-time), only a limited number of past data samples is required to analyze any signal.

As a part of the data acquisition process, groups of incoming data samples are averaged together before the result is stored for processing. Non-overlapping groups of N samples are averaged and stored, and thus reduce the effective incoming data rate to 40/N samples per second. For example, if N = 5, then a total of 40/5 or 6 (averaged) data samples are stored every second.

The value for the variable N is determined by the selection of a Peak Width parameter (PW). The relationship is

$$N = PW$$

where PW is given in seconds. Allowable values of N are 1 to 63; this range corresponds to PW values of 2 to 63 seconds.

The variable N is known as the integration factor. This term is used because N determines how many points are averaged, or integrated, to form a single value. The integration of data upon input, before storing, serves two purposes:

- The statistical noise on the input signal is reduced by the square root of N. In the case of N = 4, a noise reduction of two would be realized.
- The integration factor controls the bandwidth of the chromatograph signal. It is necessary to match the bandwidth of the input signal to that of the analysis algorithms in the Controller Assembly. This prevents small, short-duration perturbations from being recognized as true peaks by the program. It is therefore important to choose a Peak Width that corresponds to the narrowest peak in the group under consideration.

1.4.6 Peak Detection

NOTICE

The Controller Assembly software assumes that a region of signal quiescence and stability will exist.

For normal area or peak height concentration evaluation, the determination of a peak's start point and end point is automatic. The manual determination of start and end points is used only for area calculations in the Forced Integration mode. Automatic determination of peak onset or start is initiated whenever Integrate Inhibit is turned off. Analysis is started in a region of signal quiescence and stability, such that the signal level and activity can be considered as baseline values.

Having initiated a peak search by turning Integrate Inhibit off, the Controller Assembly performs a point by point examination of the signal slope. This is achieved by using a digital slope detection filter, a combination low pass filter and differentiator. The output is continually compared to a user-defined system constant called Slope Sensitivity. A default value of 8 is assumed if no entry is made. Lower values make peak onset detection more sensitive, and higher values make detection less sensitive. Higher values (20 to 100) would be appropriate for noisy signals, e.g. high amplifier gain.

Onset is defined where the detector output exceeds the baseline constant, but peak termination is defined where the detector output is less than the same constant.

Sequences of fused peaks are also automatically handled. This is done by testing each termination point to see if the region immediately following it satisfies the criteria of a baseline. A baseline region must have a slope detector value less than the magnitude of the baseline constant for a number of sequential points. When a baseline region is found, this terminates a sequence of peaks.

A zero reference line for peak height and area determination is established by extending a line from the point of the onset of the peak sequence to the point of the termination. The values of these two points are found by averaging the four integrated points just prior to the onset point and just after the termination points, respectively.

The zero reference line will, in general, be non-horizontal, and thus compensates for any linear drift in the system from the time the peak sequence starts until it ends.

In a single peak situation, peak area is the area of the component peak between the curve and the zero reference line. The peak height is the distance from the zero reference line to the maximum point on the component curve. The value and location of the maximum point is determined from quadratic interpolation through the three highest points at the peak of the discrete valued curve stored in the Controller Assembly.

For fused peak sequences, this interpolation technique is used both for peaks, as well as, valleys (minimum points). In the latter case, lines are dropped from the interpolated valley points to the zero reference line to partition the fused peak areas into individual peaks.

The use of quadratic interpolation improves both area and height calculation accuracy and eliminates the effects of variations in the integration factor on these calculations.

For calibration, the Controller Assembly may average several analyses of the calibration stream.

NOTICE

For additional information about other calculations performed, see the MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

1.5 BASIC ANALYSIS COMPUTATIONS

Two basic analysis algorithms are included in the Controller Assembly:

- Area Analysis – calculates area under component peak
- Peak Height Analysis – measures height of component peak

1.5.1 Conc Analysis - Response Factor

Concentration calculations require a unique response factor for each component in an analysis. These response factors may be manually entered by an operator or determined automatically by the system through calibration procedures (with a calibration gas mixture that has known concentrations).

The response factor calculation, using the external standard, is:

$$ARF_n = \frac{Area_n}{Cal_n} \quad \text{or} \quad HRF_n = \frac{Ht_n}{Cal_n}$$

where

ARF_n area response factor for component "n" in area per mole percent

$Area_n$ area associated with component "n" in calibration gas

Cal_n amount of component "n" in mole percent in calibration gas

Ht_n peak height associated with component "n" mole percent in calibration gas

HRF_n peak height response factor for component "n"

Calculated response factors are stored by the Controller Assembly for use in the concentration calculations, and are printed out in the configuration and calibration reports.

Average response factor is calculated as follows:

$$RFAVG_n = \frac{\sum_{i=1}^{k} RF_i}{k}$$

where

$RFAVG_n$	area or height average response factor for component "n"
RF_i	area or height average response factor for component "n" from the calibration run
k	number of calibration runs used to calculate the response factors

The percent deviation of new RF averages from old RF average is calculated in the following manner:

$$deviation = \left[\frac{RF_{new} - RF_{old}}{RF_{old}} \times 100\right]$$

where the absolute value of percent deviation has been previously entered by the operator.

1.5.2 Conc Calc - Mole Percentage (without Normalization)

Once response factors have been determined by the Controller Assembly or entered by the operator, component concentrations are determined for each analysis by using the following equations:

$$CONC_n = \frac{Area_n}{ARF_n} \quad \text{or} \quad CONC_n = \frac{Ht_n}{HRF_n}$$

where

ARF_n	area response factor for component "n" in area per mole percent
$Area_n$	area associated with component "n" in unknown sample
$CONC_n$	concentration of component "n" in mole percent
Ht_n	peak height associated with component "n" mole percent in unknown sample
HRF_n	peak height response factor for component "n"

Component concentrations may be input through analog inputs 1 to 4 or may be fixed. If a fixed value is used, the calibration for that component is the mole percent that will be used for all analyses.

NOTICE

The average concentration of each component will also be calculated when data averaging is requested.

1.5.3 Conc Calc in Mole Percentage (with Normalization)

The normalized concentration calculation is:

$$CONCN_n = \frac{CONC_n}{\sum_{i=1}^{k} CONC_i} \times 100$$

where

$CONCN_n$	normalized concentration of component "n" in percent of total gas concentration
$CONC_i$	non-normalized concentration of component "n" in mole percent for each "k" component
$CONC_n$	non-normalized concentration of component "n" in mole percent
k	number of components to be included in the normalization

1.6 ADDITIONAL RESOURCES

In addition to this manual, Model 700 *Gas Chromatograph System Reference Manual*, refer to the following:

- MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522). Use this manual for installing the MON2000 and Modbus Test (WinMB) software programs, getting started, checking various gas chromatograph (GC) application settings, and configuring and monitoring your GC system.

1.7 GLOSSARY

Auto Zero

Automatic zeroing of the TCD preamplifier may be configured to take place at any time during the analysis when either the component is not eluting or the baseline is steady.

The Micro-FID is automatically zeroed at each new analysis run and can be configured to take place anytime during the analysis when either the component is not eluting or the baseline is steady. The TCD is only automatically zeroed at the start of a new analysis.

Baseline

Signal output when there is only carrier gas going across the detectors. In a chromatogram you should only see Baseline when running an analysis without injecting a sample.

Carrier Gas

The gas used to push the sample through the system during an analysis. In C6+ analysis we use Ultra Pure (zero grade) Carrier Gas for the carrier. This gas is 99.995 percent pure.

Chromatogram

A permanent record of the detector output. A chromatograph is obtained from a PC interfaced with the detector output through the Controller Assembly. A typical chromatogram displays all component peaks, and gain changes. It may be viewed in color as it is processed on a PC VGA display. Tick marks recorded on the chromatogram by the Controller Assembly indicate where timed events take place.

Component

Any one of several different gases that may appear in a sample mixture

For example, natural gas usually contains the following components: nitrogen, carbon dioxide, methane, ethane, propane, isobutane, normal butane, isopentane, normal pentane, and hexanes plus.

Condulet

A box with a removable cover providing access to wiring in conduit (conduit outlet) that is part of an optional cable entry package.

CTS

Clear to send

DCD

Data carrier detect

DSR

Data set ready

DTR

Data terminal ready

FID

Flame Ionization Detector - The optional Micro-FID may be used in place of one TCD for the detection of trace compounds. The Micro-FID requires a polarization voltage and its output is connected to the input to a high impedance amplifier, an Electrometer. The sample of gas to be measured is injected into the burner with a mixture of hydrogen and air to maintain the flame.

LSIV

Liquid Sample Inject Valve - The optional LSIV is used to convert a liquid sample to a gas sample by vaporizing the liquid in a heated chamber, then analyzing the flashed sample.

Methanator

The optional Methanator, a catalytic converter, converts otherwise undetectable CO_2 and/or CO into methane by adding hydrogen and heat to the sample.

Response Factor

Correction factor for each component as determined by the calibration:

$$RF = \frac{RawArea}{CalibrationConcentration}$$

Retention Time

Time (in seconds) that elapses between the start of analysis (0 seconds) and the sensing of the maximum concentration of each component by the detector.

RI

Ring indicator

RLSD

Received Line Signal Detect (a digital simulation of a carrier detect).

RTS

Request to send

RxD, RD, or S_{in}

Receive data, or signal in

TCD

Thermal Conductivity Detectors – Detectors that use thermal conductivity of the different gas components to produce an unbalanced signal across the bridge of the preamplifier. The higher the temperature the lower the resistance on the detectors.

TxD, TD, or S_{out}

Transmit data, or signal out

EQUIPMENT DESCRIPTION AND SPECIFICATIONS

Use the following sections to reference the Model 700 equipment description or specifications.

2.1 EQUIPMENT DESCRIPTION

The Model 700 consists of two copper-free aluminium explosion-proof housings, upper and lower, and a front flow panel assembly. The enclosures are separated by a pipe conduit which routes electrical wiring from the lower enclosure to the upper enclosure. Designed to be explosion-proof, this unit is built for installation in hazardous locations.
See Section 3.1 for more information.

Figure 2-1 Model 700 Gas Chromatograph

NOTICE

All circuit boards are connected through a common ground via the enclosure.

2.1.1 Upper Enclosure

The Model 700 upper explosion-proof housing contains the electronic controller (multifunction board), the Oven System, the Stream Switching System (SSS) and preamplifier assembly.

Model 700 Upper Enclosure

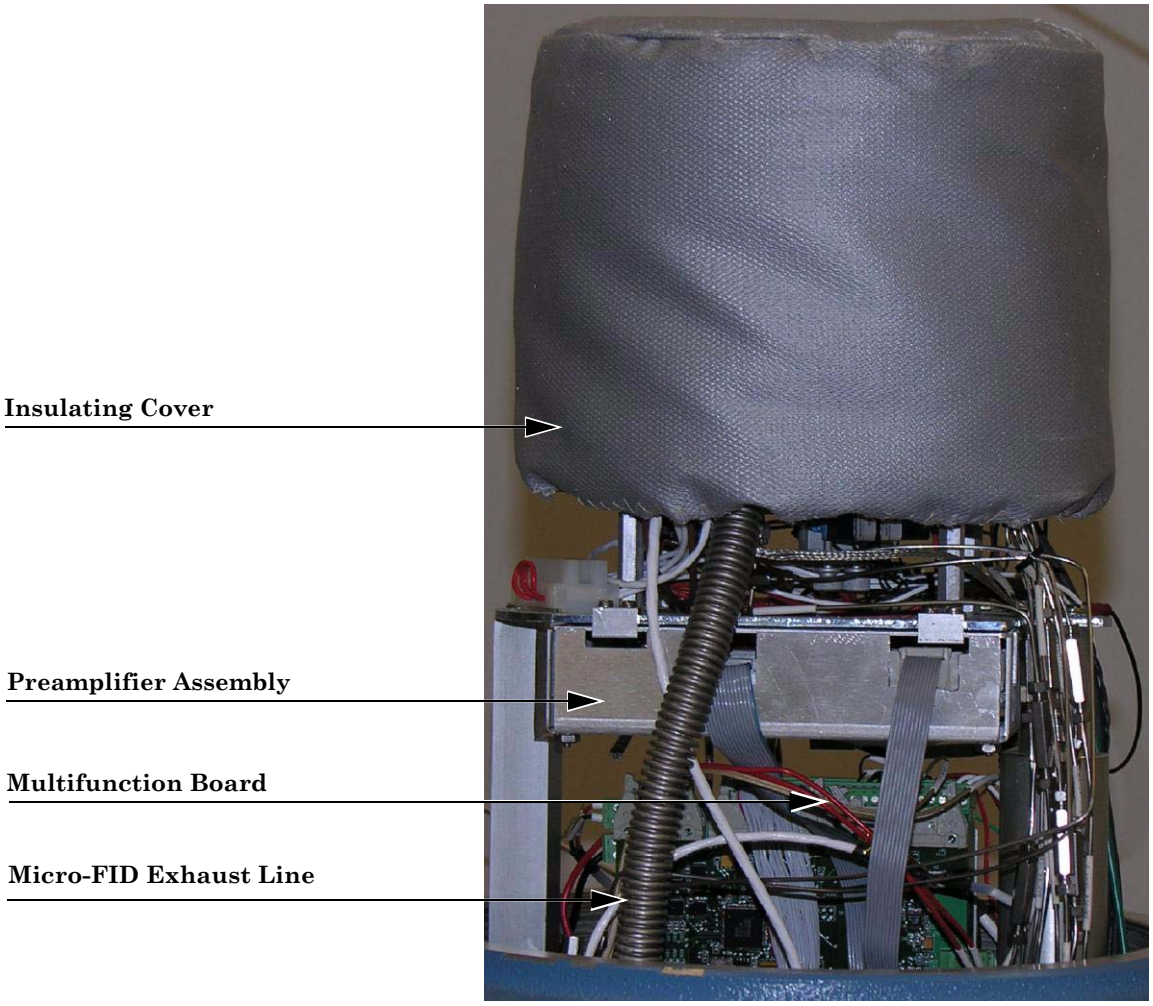


Figure 2-2 Upper Enclosure Assembly

A more detailed equipment list includes:

- TCD Oven System (consists of the electronics, up to three chromatograph valves and the stream switching system):
  - column module (i.e., “oven”)
  - one or two pairs thermal conductivity detectors (TCDs)
  - valve system consisting of:
    - three sample-directing valves
    - plastic manifold that thermally insulates the Oven System and connects the actuating part to the solenoid valves attached to the plastic manifold
  - two heater zones: column with one cartridge heater and one block with three heaters
  - two thermal cut-off switches: (oven temperature switch) opens at 257°F (±5 °) (125 °C)

Model 700 Upper Enclosure

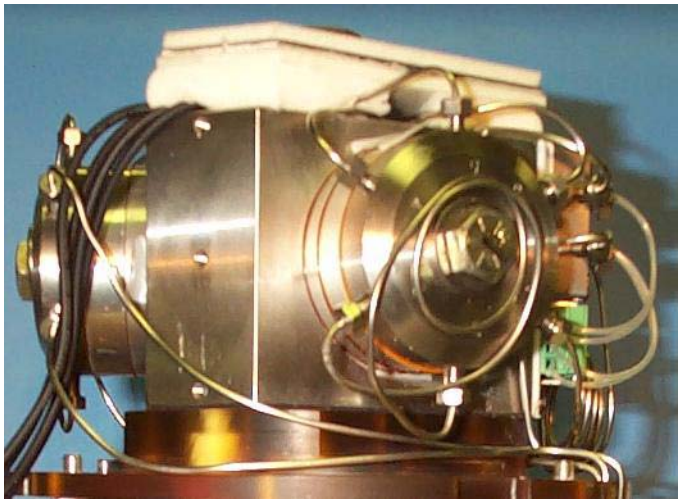


Figure 2-3 TCD Oven System Assembly

- Micro-FID

Model 700 FID Upper Enclosure

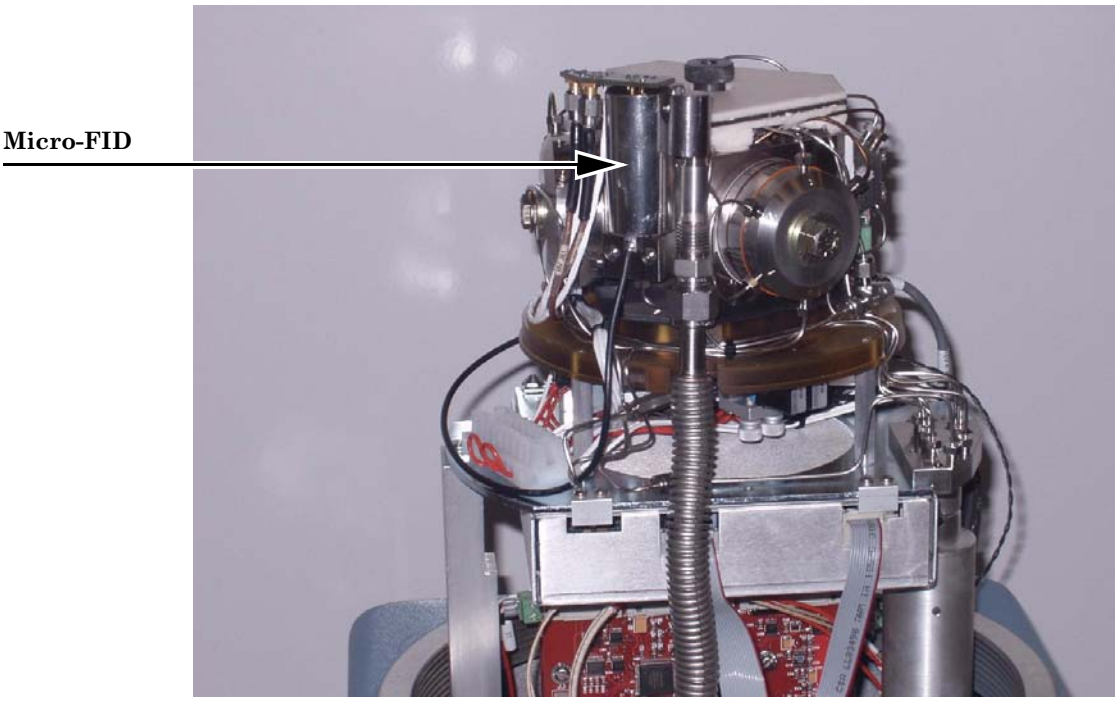


Figure 2-4 Model 700 Micro-FID Upper Assembly

The optional Flame Ionization Detector may be used in place of one TCD for the detection of trace levels of compounds.

- Methanator

Model 700 Methantor Upper Enclosure

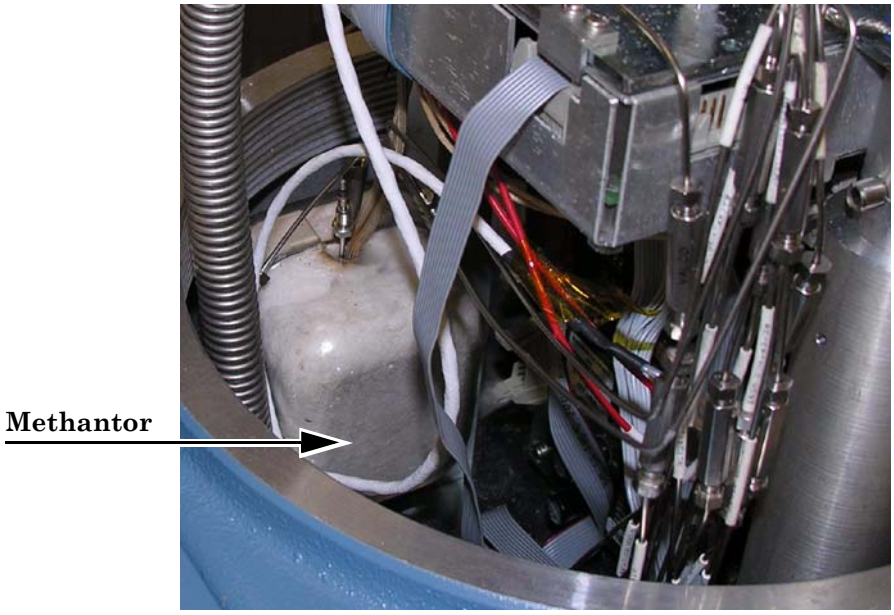
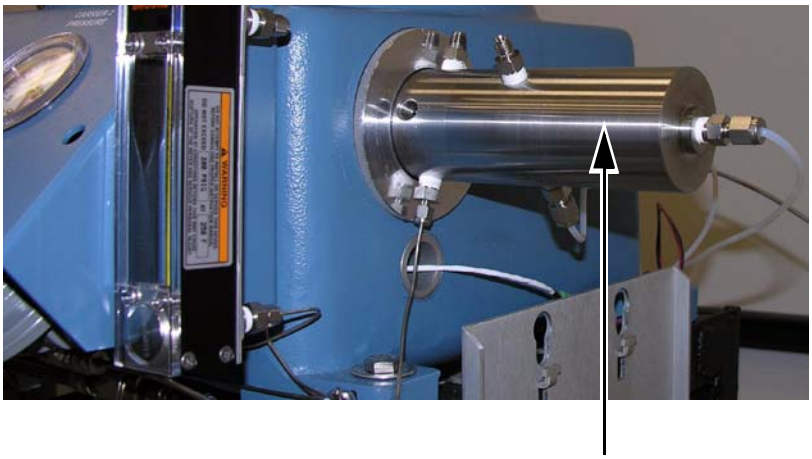


Figure 2-5 Model 700 Methanator Upper Assembly

The optional Methanator, a catalytic converter, converts otherwise undetectable CO_2 and/or CO into methane by adding hydrogen and heat to the sample.

Model 700 LSIV Right Side View



LSIV Assembly

Figure 2-6 LSIV Assembly

The optional Liquid Sample Inject Valve (LSIV) is used to convert a liquid sample to a gas sample for analysis on the Model 700 Gas Chromatograph.

A measured sample is placed in a heated chamber above the vaporization point of the liquid and then it is flashed to a gas. Once vaporized, the sample is pushed by the carrier gas through the heated tubing into the column train.

- Stream Switching System (SSS) which consists of:
  - manifold block
  - solenoid valves
  - valve clamps
  - temperature sensor
  - oven temperature switch
  - tubing
  - insulation cover

Model 700 Upper Enclosure

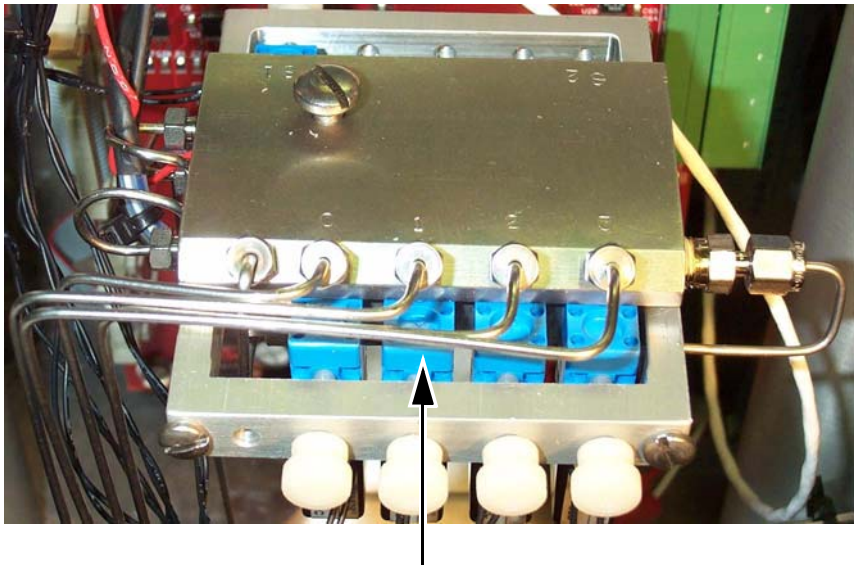


Figure 2-7 SSS Installed

- TCD Electronics
  - Dual Methods Adapter Board
  - Driver I/O Board
  - Multifunction Board
  - Preamplifier Board
  - External Locking Device

- Micro-FID Electronics
  - Solenoid/Heater Driver Board
  - Multifunction Board
  - Preamplifier Power supply
  - Driver I/O Board
  - Multifunction Board

2.1.2 Lower Enclosure

The Model 700 lower enclosure consists of:

Model 700 Lower Enclosure

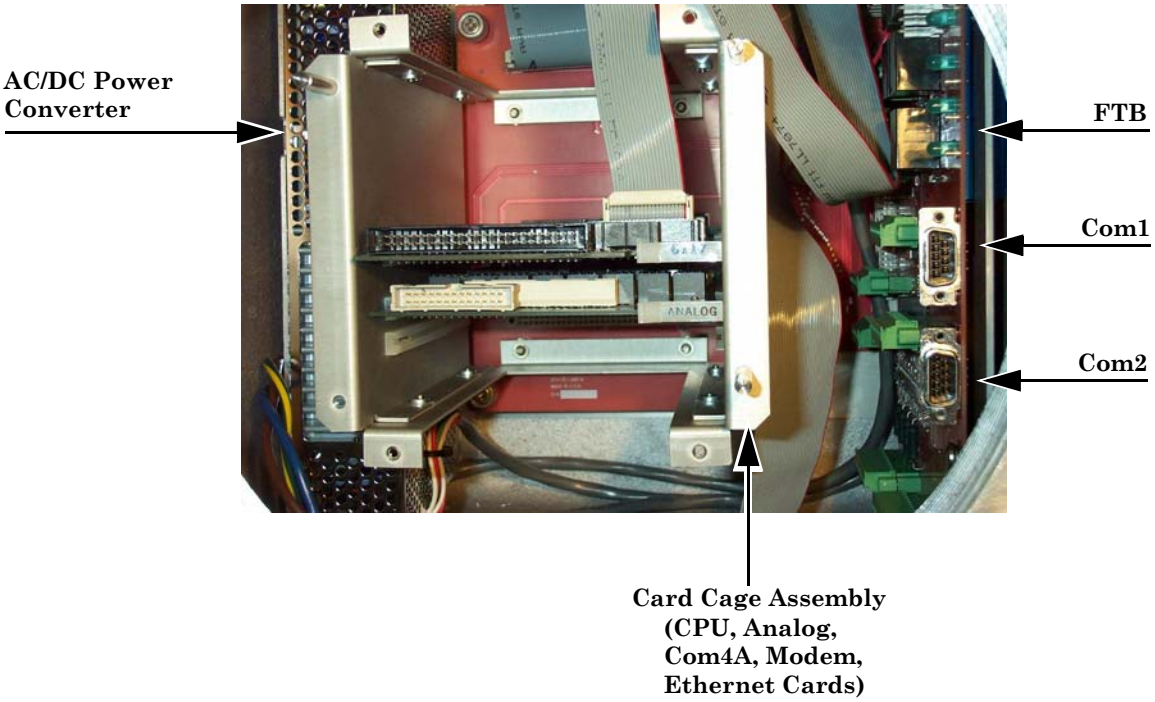


Figure 2-8 Lower Enclosure Assembly

- Card cage assembly, containing:

WARNING

DANGER TO PERSONNEL AND EQUIPMENT

See power supply label prior to connection. Check the unit power design to determine if it is equipped for AC or DC power. Applying 110/220 VAC to a DC power input unit will severely damage the unit.

Failure to do so may result in injury or death to personnel or cause damage to the equipment.

- WinSystems CPU board
- Com4A board (optional)
- analog board
- analog board (optional)
- digital I/O
- internal modem (optional)
- ethernet card (optional)
- field termination board (FTB)
- connection for AC/DC power supply (converter)
- internal and external ground
- external locking device
- DB pin connection for serial communications

NOTICE

The Model 700 CSA-certified unit is equipped with 3/4 inch cross-over adapters.

CAUTION

If the carrier gas pressure drops below a set point, this switch causes the analysis to stop and activates the analyzer failure alarm.

2.1.3 Flow Panel Assembly

The Flow Panel Assembly is attached to the front of the upper enclosure and consists of the following: (see Figure 2-2):

- carrier pressure regulator(s) and gauge(s)
- sample flow meter
- Sample Vent (SV)
- Measure Vent (MV)
- actuation pressure limiting regulator
- pressure switch, mounted internally

2.2 EQUIPMENT SPECIFICATIONS

2.2.1 Utilities

Use the following table to determine the utility specifications.

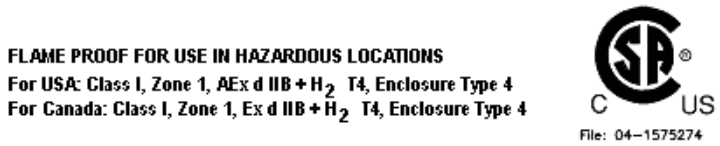
Table 2-1 Model 700 Unit Specifications

Type	Specification
unit dimensions (P/N 20351)	• basic unit envelope w - 15.2" (387 mm) h - 41.5" (1054 mm) d - 19.2" (488 mm) • wall mount w - 18.2" (463 mm) h - 41.5" (1054 mm) d - 19.2" (488 mm) • pole mount w - 18.2" (463 mm) h - 41.5" (1054 mm) d - 25.0" (635 mm) • floor mount w - 18.2" (463 mm) h - 58.0" (1470 mm) d - 19.2" (488 mm)
unit weight	• wall mount 130 lbs (59 kg) • pole mount 135 lbs (61 kg) • floor mount 150 lbs (68)
materials	• 303 and 316 stainless steel • 316 stainless steel and Kapton in contact with sample • Swagelock and Valco fittings
mounting	• floor mount • pole mount: - 2" (60.3 mm) - 3" (89.0 mm) - 4" (114.3 mm) • direct wall mount

NOTICE

Allow 14" (360 mm additional) clearance for removal of dome.

Table 2-1 Model 700 Unit Specifications

Type	Specification
power	• 24VDC standard (23-28 VDC operating voltage range); 80 watts • AC optional 90-130/180-264 VAC; 47-63 Hz; 80 watts 80 watts start-up; 33 watts nominal • 47-63Hz (single phase) • 75W (Model 700 w/TCD) • 150W (Model 700 w/Methanator or LSIV) • 36VDC, Sol/Drv PCB Transorb
instrument air	not required; optional for valve actuation, minimum pressure of 90 psig
environment	• -18 to 55 °C (0 to 130 °F) • 0 to 95% RH (non-condensing) • indoor/outdoor • pollution - degree 2 (the unit can withstand some non conductive environmental pollutants e.g., humidity) • max altitude 2000m
approvals	• For Canada: Class I, Zone 1, Ex d IIB (+H_2), T4, Enclosure Type 4 • For USA: Class I, Zone 1, AEx d IIB (+H_2), T4, Enclosure Type 4  • IEC Class I, Zone 1, EEx d IIC T4

NOTICE

Voltage range includes line voltage variations.

Ensure the Model 700 receives at least 23 VDC at the terminals. If the power supply is located more than 164 feet (50 meters) from the GC, a voltage drop may occur across the cable and cause the solenoids to fail.

If your GC installation is more than 164 feet (50 meters) away from the power supply, use an AC power supply to avoid problems with a voltage drop across the cable

2.2.2 Electronic Hardware

Review the system block diagrams, Upper and Lower Electronics, to become familiar with the Model 700.

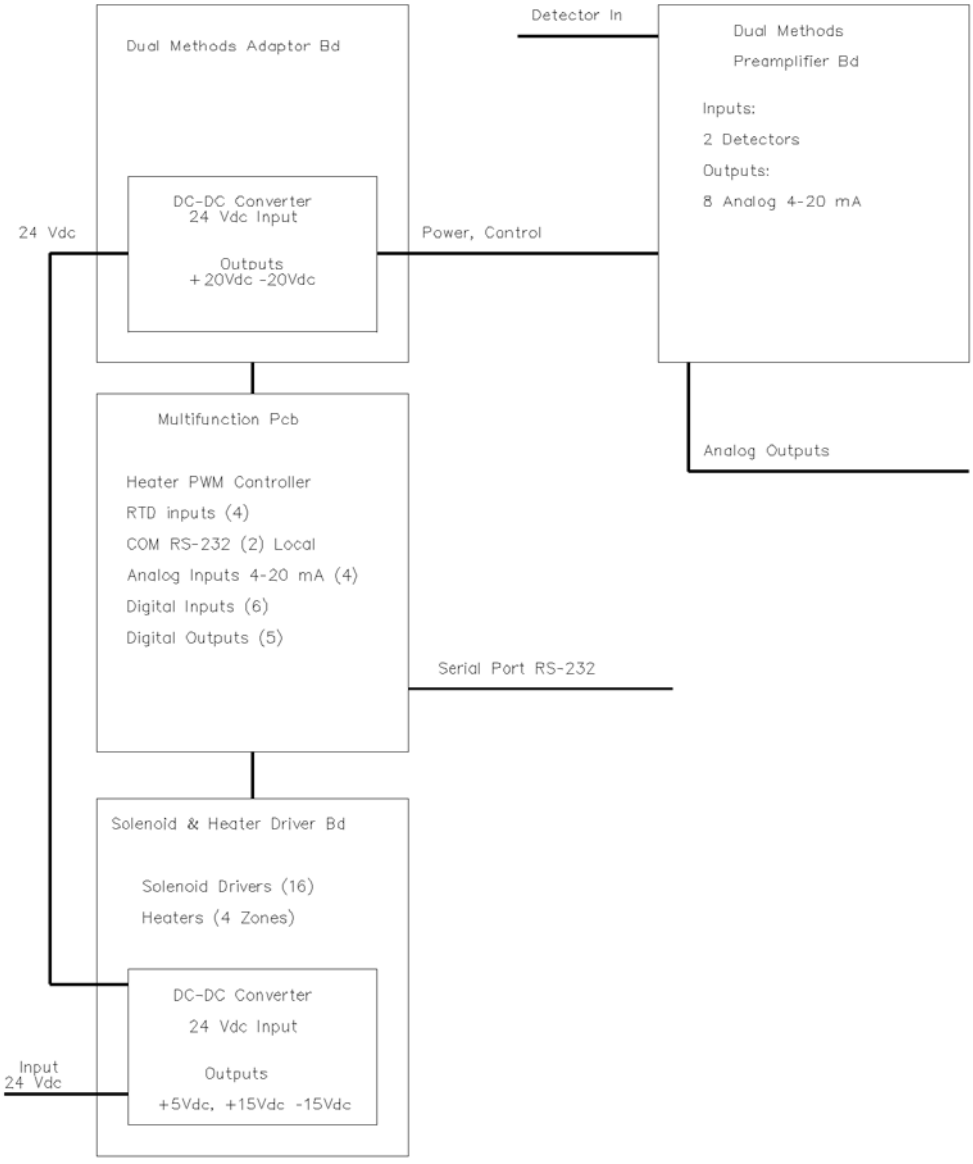


Figure 2-9 Upper Electronics with TCD Block Diagram

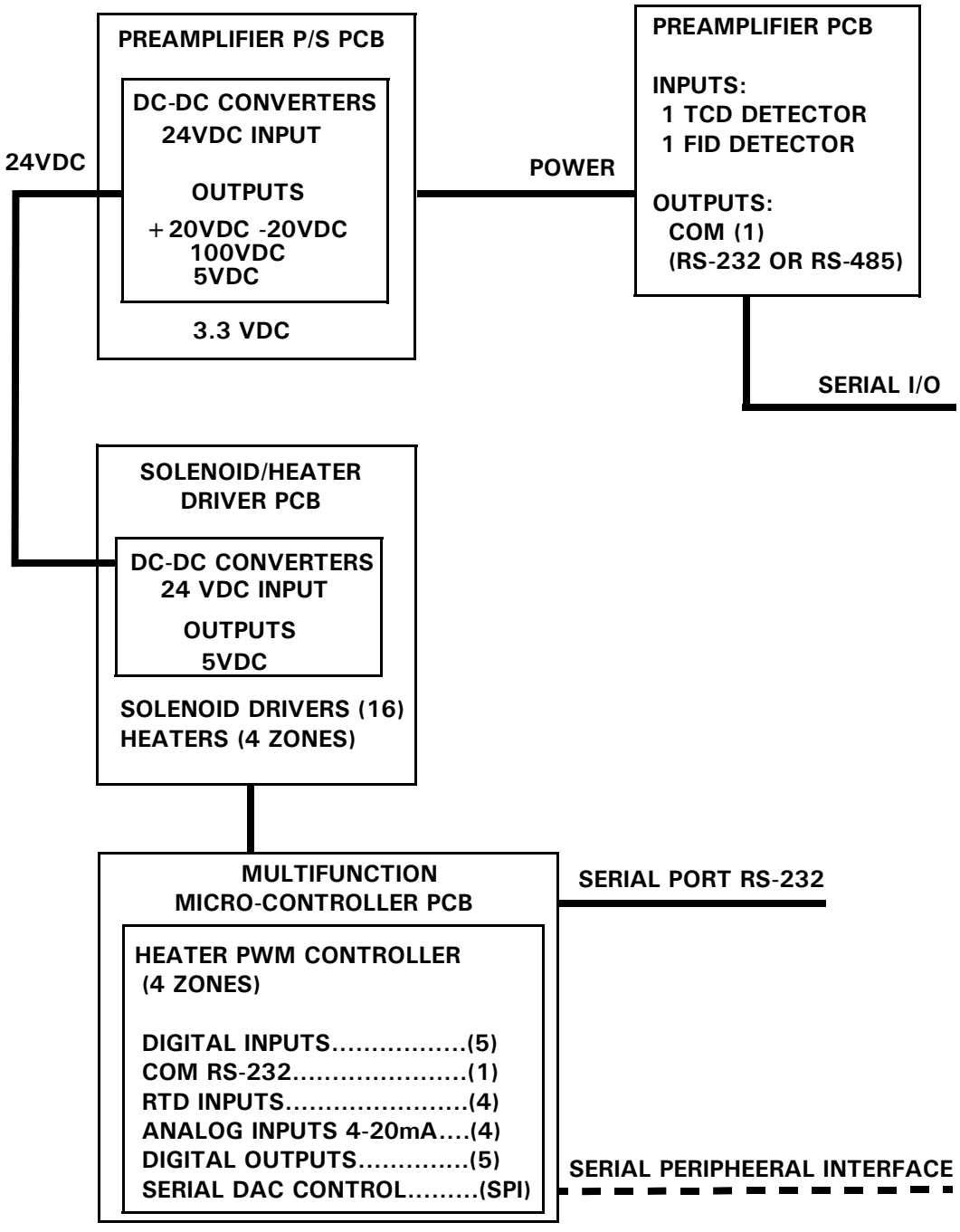


Figure 2-10 Upper Electronics with Micro-FID Block Diagram

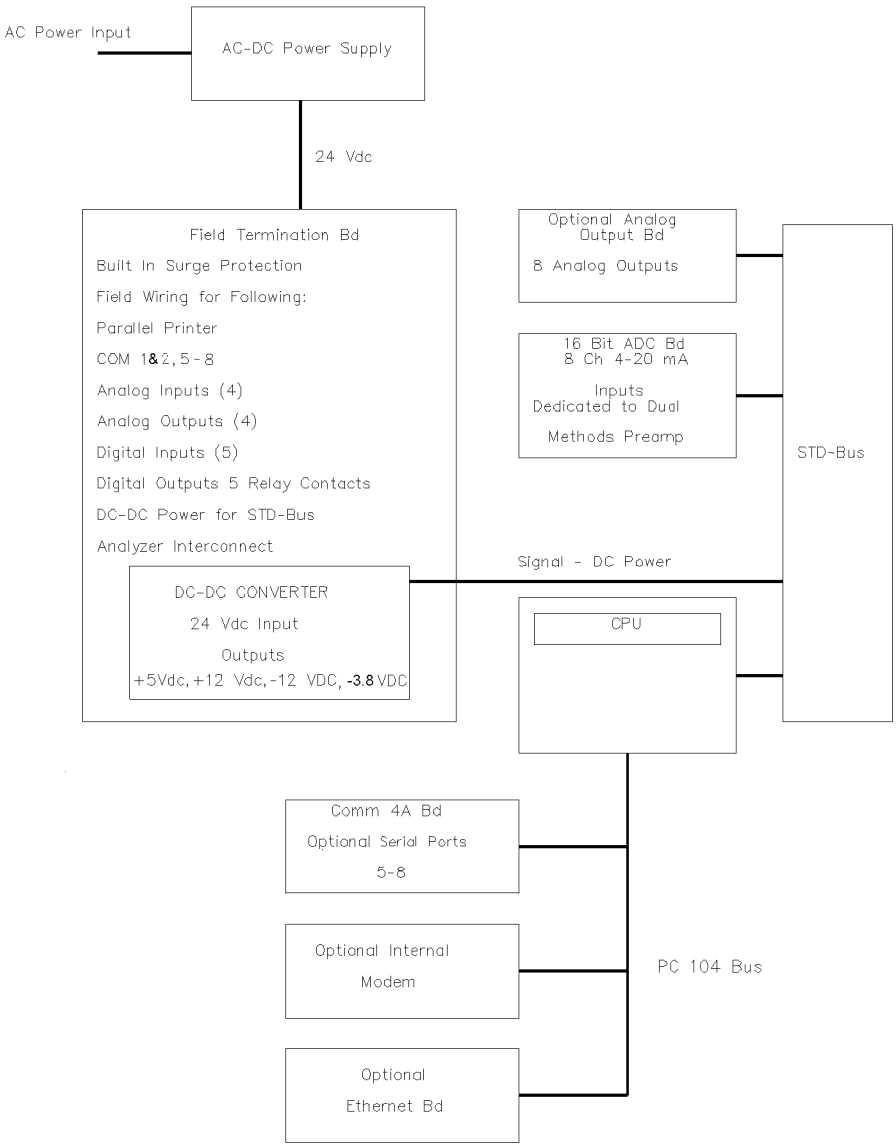


Figure 2-11 Lower Electronics TCD Block Diagram

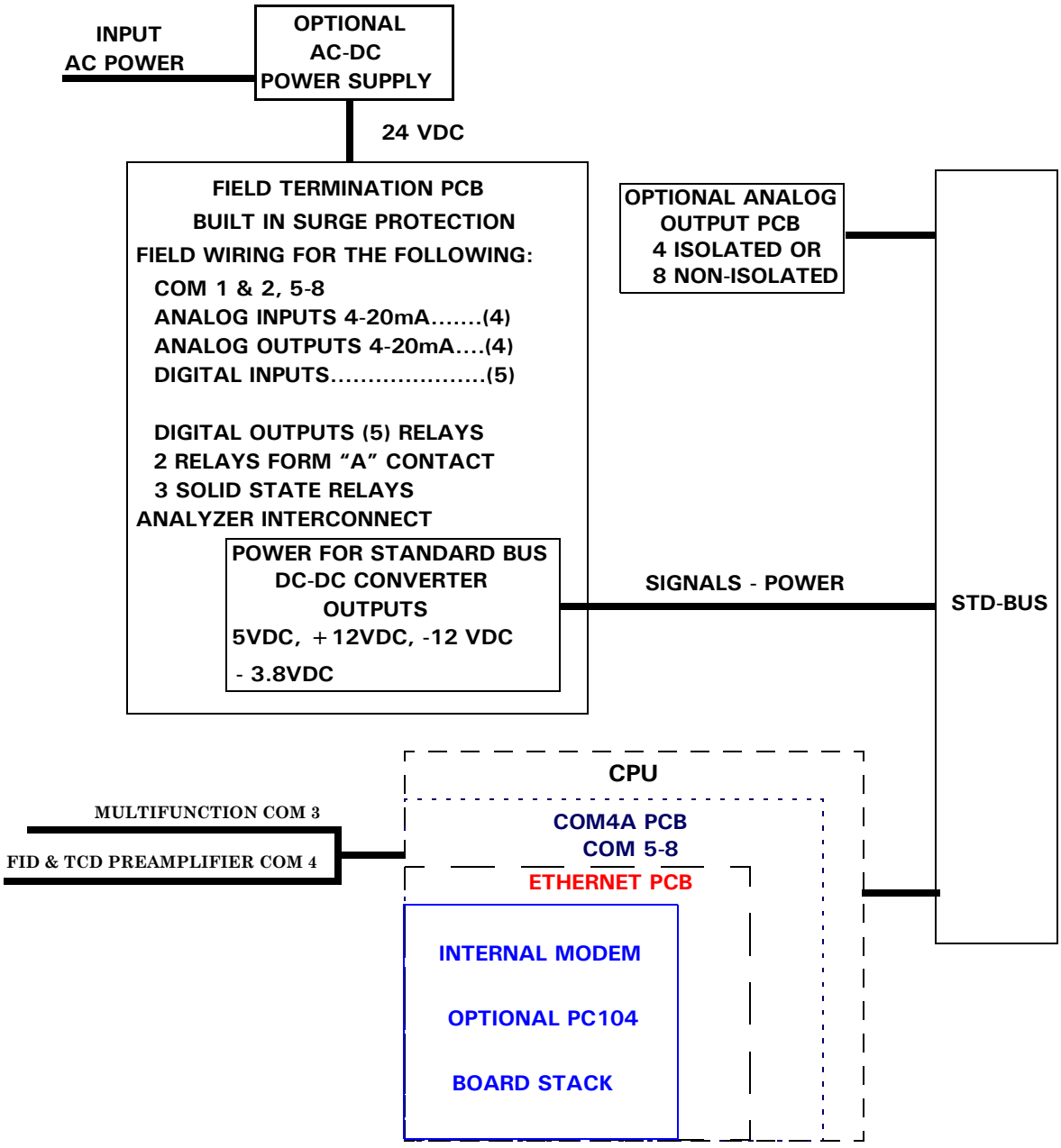


Figure 2-12 Lower Electronics Micro-FID Block Diagram

Use the following table to determine the electronic hardware specifications.

Table 2-2 Electronic Hardware Specification

Type	**Specification**
Rating	Division 1; no purge required
CPU	WinSystems 386sx 33 MHz
Memory	4 MB System RAM
DiskOnChip	8 MB – 288 MB
Communication Ports	6 configurable Modbus ports; support RS-232/422/485 protocols
Optional Modem	56K Baud Telephone
Analog Inputs	4, 12-pin Phoenix on FTB
Standard Analog Outputs	4, 12-pin Phoenix on FTB
Optional Analog Outputs	8, non-isolated outputs 24-pin Phoenix Located on Optional Analog Board Or, 4, isolated outputs 12-pin Phoenix connector Located on Optional Analog Board
Discrete Digital Inputs	GC_IN (dedicated to pressure switch); 4 user-defined inputs
Digital Outputs (5)	2 Relays “Form A” contacts Relay contact rating 24 VDC nominal @ 1 Amp 3 Solid State Relays - Rating of 0.375A @30 VDC on FTB - 10 pin Phoenix connector
Detector Inputs	Optionally 2 micro-volume TCD inputs 1 Flame Ionization Detector (Micro-FID) input
Transient Protection	over-voltage category II

2.2.3 Micro Heat Sink Oven

Use the following table to determine the oven specifications.

Table 2-3 Oven Assembly Specifications

Type	Specification
Valves	6-port and 10-port valves; piston-operated diaphragms with pneumatic actuation
Columns	max of 40 feet (12 m) of micro-packed columns; 1/16-inch (1.6-mm) outside diameter
Solenoid Actuation	• 24 VDC • max 90 psi
Wetted Parts	316 stainless steel and kapton diaphragm
Temperature Control	• 24 VDC heat sink • 2 zones (1 column, 1 block) • max operating temperature of 115 °C (239 °F)
Sample System	1 zone, includes Stream Switching System
Sample Streams	• standard: max of 3 analytical and 1 auto calibration • optional: max of 8

NOTICE

The Model 700 has its own applications and is not compatible with 2350/ 2350A applications.

2.2.4 Software

Use the following table to determine the software specifications.

Table 2-4 Software Specifications

Type	Specification
Software	PC-based MON2000; runs 2350 and 2350A applications (v2.4 or later)
Firmware	embedded firmware compatible with 2350/2350A applications (v1.8 or later)
Methods	4 Timed Event Tables and 4 Component Data Tables assignable to each stream
Peak Integration	• fixed time or auto slope and peak identification • update Retention Time upon calibration or during analysis

This page is intentionally left blank.

INSTALLATION AND SETUP

This section provides instructions for installing and setting up the Model 700 Gas Chromatograph (GC) System for Zone 1/ Division I environments.

This procedure involves the following steps:

- observe precautions and warnings
- plan site location
- obtain supplies and tools
- install GC wiring
- install GC sample and gas lines
- perform leak checks
- purge carrier gas lines
- purge calibration lines
- start up GC system

3.1 PRECAUTIONS AND WARNINGS

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Install and operate all equipment as designed and is compliant with all safety requirements.

The "Seller" does not accept any responsibility for installations of the Model 700, or any attached equipment, in which the installation or operation thereof has been performed in a manner that is negligent and/or non-compliant with applicable safety requirements.

3.1.1 Hazardous Environments

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Observe all precautionary signs posted on the Model 700 enclosure.

Failure to do so may result in injury or death to personnel or cause damage to the equipment.

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Observe all precautionary signs posted on the Model 700 enclosure.

The Model 700 enclosures are certified by CSA for Class I, Zone 1, AEx d IIB (+H2) T4 locations and are certified by SIRA for IEC Class I, Zone 1, EEx d IIC T4.

ATEX certified units must be installed strictly in compliance with the requirements of IEC 60079-14.

Special conditions for safe use must be met. The maximum constructional gap (i_c) is less than that required by Table 1 of IEC 60079-1:2004 as detailed in the Table 3-1 below.

Before opening the Model 700 assembly, reduce the risk of igniting hazardous atmospheres by disconnecting the equipment from all power supplies. Keep the assembly closed tightly when in operation to reduce the risk of igniting hazardous atmospheres.

Inlet (incoming) wiring must meet local standards (i.e. in conduit with seal fitting within 18" or via cable glands certified to IEC 60079-1). Seal all unused entries with blanks certified to IEC 60079-1.

Observe all precautionary signs posted on the Model 700 enclosure. Failure to do so may result in injury or death to personnel or cause damage to the equipment.

Please direct all health, safety and certification related questions to: Emerson Process Management, Gas Chromatographs, Applications Engineering Group, 713-827-6380 or 1-866-GC Center (1-866-422-3683).

Table 3-1 Flamepath Fitting Tube Gap Safety

FLAMEPATH	MAXIMUM GAP (MM)	COMMENT
Fitting tube adaptor/fitting tube taper	0.000	Taper fit
Fitting tube/taper/tubes	0.132	

Follow these precautions if installing or operating the Model 700 instrumentation in a hazardous area:

1. Install and operate only the Zone 1/ Division I version of the Model 700 in a hazardous area.
2. Do not operate any printer or personal computer (PC) that is connected to a GC which is installed in a hazardous area. To interface with a GC in a hazardous area, use a PC that is located in a nonhazardous area and remotely connected to the GC.
3. Ensure that field connections to the analyzer are made through explosion-proof conduit or flameproof glands.

3.1.2 Power Source Wiring

Follow these precautions when installing AC power source wiring:

1. All wiring must conform to the CEC or NEC, local state or other jurisdiction, and company standards and practices.
2. Provide 24 VDC (23-28 VDC range) power or optional single-phase, 3-wire, power at 115 or 230 VAC, 47-63 Hertz.
3. Locate circuit breaker and optional power disconnect switch in a safe area.

CAUTION

15 amps is the maximum current for 14 AWG (wire).

4. Provide the Model 700 system and any optionally installed devices with one 15-Amp circuit breaker for protection.
5. Ensure that the 24 VDC input power is S.E.L.V. compliant by suitable electrical separation from other circuits.

6. Use multi-stranded copper conductor wire according to the following recommendations:
   - For power feed distances up to 250 feet (76 meters), use 14 AWG (American Wire Gauge) (18 Metric Wire Gauge), stranded.
   - For power feed distances 250 to 500 feet (76 to 152 meters), use 12 AWG (25 Metric Wire Gauge), stranded.
   - For power feed distances 500 to 1000 feet (152 to 305 meters), use 10 AWG (30 Metric Wire Gauge), stranded.
   - Cable entries are M32 in accordance with ISO 965.

3.1.3 Card Cage Removal

The Model 700 card cage assembly is designed to be disconnected and removed from the lower enclosure to allow space for user power and signal connections. This may be particularly important for applications where large numbers of I/O connections are required.

To disassemble the Card Cage,

1. Remove the lower enclosure cover and the front flow panel assembly.

Note: Leave the wires attached to the flow panel assembly and allow it to hang outside of the enclosure.

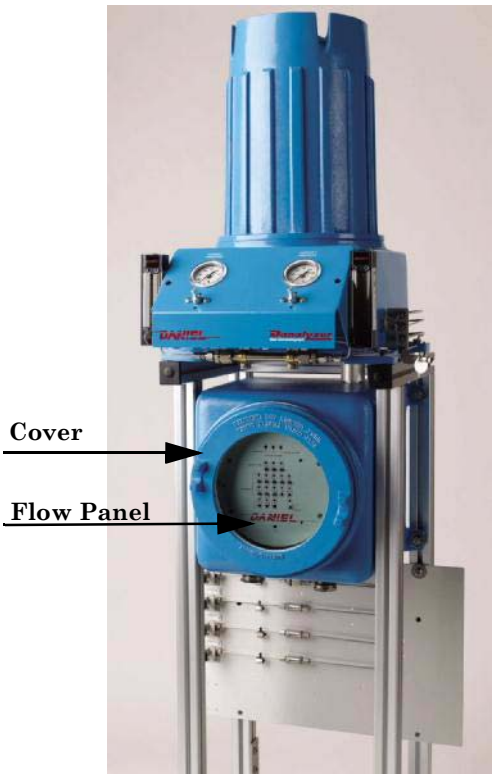


Figure 3-1 Lower Enclosure Disassembly

2. Carefully disconnect all of the ribbon cables from the boards in the card cage assembly (CPU, Analog, Modem, Ethernet, etc.).

NOTICE

Note the location of the ribbon cables for ease of reassembly.

Flow Panel

Figure 3-2 Card Cage Cable Disassembly

3. Use a Phillips head screw driver and remove the two screws located at the top of the card cage and one screw on the bottom left side of the card cage (not visible in the figure).

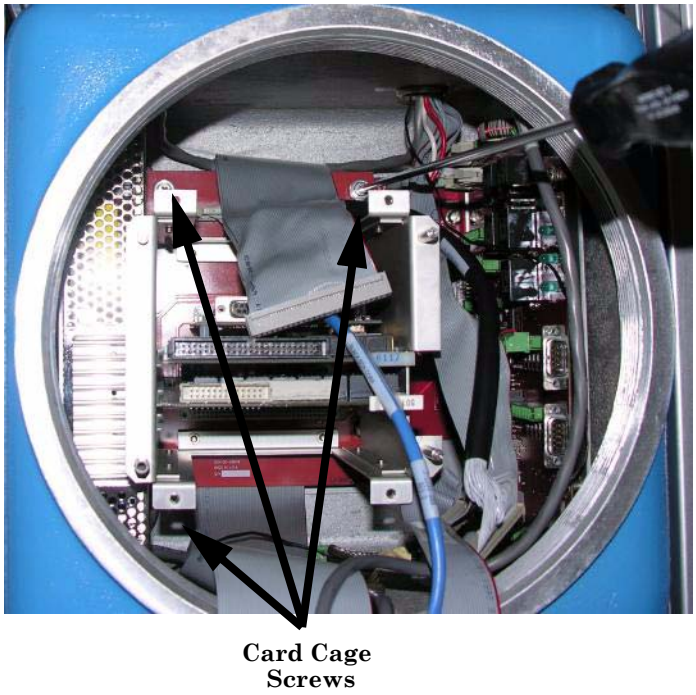


Figure 3-3 Card Cage Assembly Screw Locations

4. Slide the card cage assembly out of the lower enclosure.

Figure 3-4 Card Cage Disassembly

5. User power and signal connections may be made with the card cage removed from the lower enclosure.

Figure 3-5 Card Cage Disassembly for Power and Signal Wiring

3.1.4 Signal Wiring

Follow these general precautions for field wiring digital and analog input/output (I/O) lines:

CAUTION

DANGER TO PERSONNEL AND EQUIPMENT

Observe all precautionary signs posted on the Model 700 enclosure. Applicable to all digital and analog I/O lines connecting to the GC: Any loop of extra cable left for service purposes inside the GC housing must not be placed near any AC power lines.

If this precaution is not followed, the data and control signals to and from the GC can be adversely affected.

- Metal conduit must be used for all process signal wiring (assuming operation in a Class 1, Division 1 Explosive Area). Metal conduit is not required for use in general purpose areas.
- Metal conduit or cable (in compliance with EN 60079-14) used for process signal wiring must be grounded at conduit support points (intermittent grounding of conduit helps prevent induction of magnetic loops between the conduit and cable shielding).
- All process signal wiring should be a single, continuous length between field devices and the GC. If, however, length or conduit runs require that multiple wiring pulls be made, the individual conductors must be interconnected with suitable terminal blocks.
- Use suitable lubrication for wire pulls in conduit to prevent wire stress.

- Use separate conduits for AC voltage and DC voltage circuits.
- Do not place digital or analog I/O lines in same conduit as AC power circuits.
- Use only shielded cable for digital I/O line connections.
  - Ground the shield at only one end.
  - Shield-drain wires must not be more than two AWG sizes smaller than the conductors for the cable.
- When inductive loads (relay coils) are driven by digital output lines, the inductive transients must be diode-clamped directly at the coil.
- Any auxiliary equipment wired to the GC must have its signal common isolated from earth/chassis ground.

3.1.5 Electrical and Signal Ground

Follow these general precautions for grounding electrical and signal lines:

- For shielded signal conducting cables, shield-drain wires must not be more than two AWG sizes smaller than the conductors for the cable. Shielding is grounded at only one end.
- Metal conduit used for process signal wiring must be grounded at conduit support points (intermittent grounding of conduit helps prevent induction of magnetic loops between the conduit and cable shielding).

- A single-point ground (the outside case ground lug) must be connected to a copper-clad, 10-foot long, 3/4-inch diameter steel rod, which is buried, full-length, vertically into the soil as close to the equipment as is practical (note: the grounding rod is not furnished.)

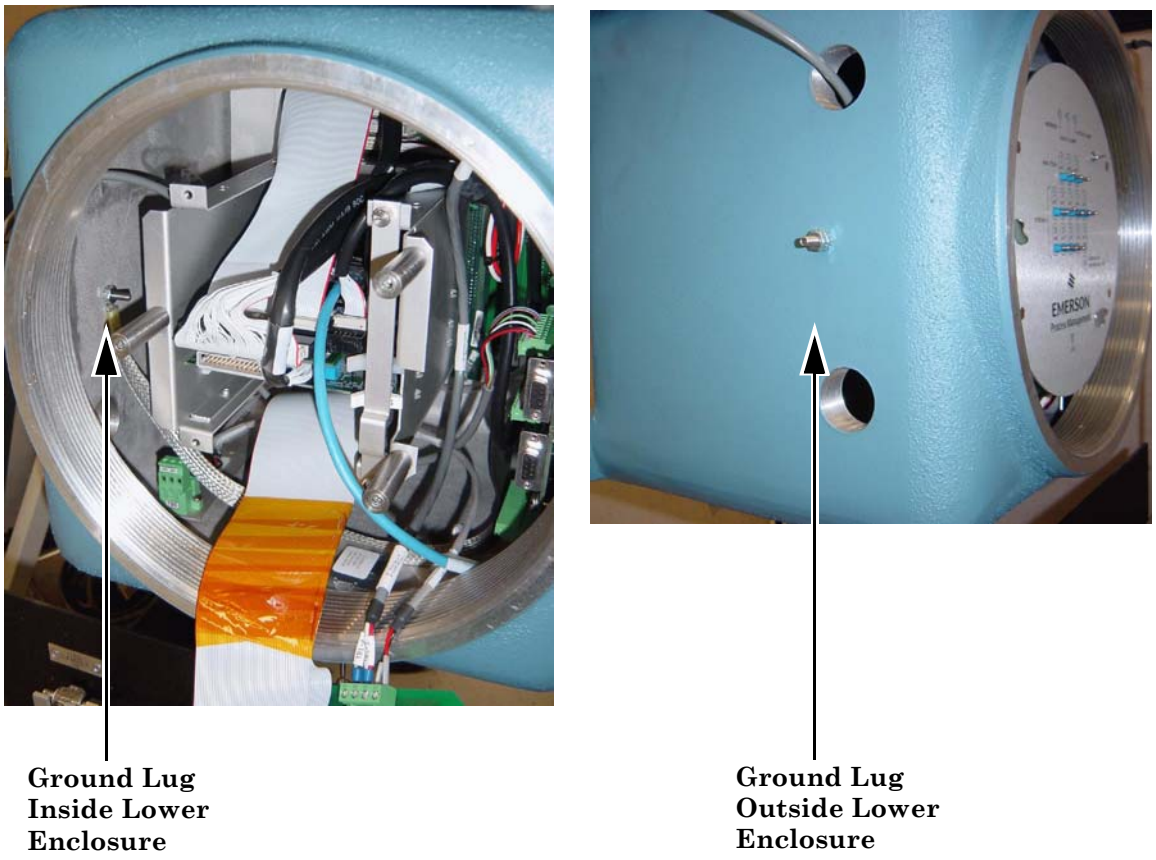


Figure 3-6 Ground Lug Lower Enclosure

- Resistance between the copper-clad steel ground rod and the earth ground must not exceed 25 Ohms.
- On ATEX certified units, the external ground lug must be connected to the customer's protective ground system via AWG 9 (6mm^2) ground wire. After the connection is made, apply a non-acidic grease to the surface of the external ground lug to prevent corrosion.

- The equipment-grounding conductors used between the GC and the copper-clad steel ground rod must be sized according to the following specifications:

Length	Wire
15 ft. (4.6 m) or less	8 AWG stranded, insulated copper
15 to 30 ft. (4.6 to 9.1 m)	6 AWG stranded, insulated copper
30 to 100 ft. (9.1 to 30.5 m)	4 AWG stranded, insulated copper

- All interior enclosure equipment-grounding conductors must be protected by metal conduit.
- External equipment, such as data printers, that are connected to the GC should be powered via isolation transformers to minimize the ground loops caused by the internally shared safety and chassis grounds.

3.1.6 Electrical Conduit

Follow these general precautions for conduit installation:

- Conduit cutoffs must be square. Cutoffs must be made by a cold cutting tool, hacksaw, or by some other approved means that does not deform the conduit ends or leave sharp edges.
- All conduit fitting-threads, including factory-cut threads, must be coated with a metal-bearing conducting grease, such as Crouse-Hinds STL or equivalent, prior to assembly.

- Temporarily cap the ends of all conduit runs immediately after installation to prevent accumulation of water, dirt, or other contaminants. If necessary, swab out conduits prior to installing the conductors.
- Install drain fittings at the lowest point in the conduit run; install seals at the point of entry to the GC explosion-proof housing to prevent vapor passage and accumulation of moisture.
- Use liquid-tight conduit fittings, such as Myers Scru-tite or similar, for conduits exposed to moisture.

When conduit is installed in hazardous areas (e.g., areas classified as NEC Class I, Division 1, Groups B, C, and D), follow these general precautions for conduit installation:

DANGER TO PERSONNEL AND EQUIPMENT

Observe all precautionary signs posted on the equipment. Consult your company policies and procedures and other applicable requirements documents to determine wiring and installation practices that are appropriate for hazardous areas.

Failure to do so may result in injury or death to personnel or cause damage to the equipment.

- All conduit runs must have a fitting, which contains explosion-proof sealing (potting) located within 18 inches from the conduit entrance to the explosion-proof housing.
- The conduit installation must be vapor tight, with threaded hub fittings, sealed conduit joints and gaskets on covers, or other approved vapor-tight conduit fittings.

3.1.7 Sample System Requirements

Observe the following guidelines for installing GC sample systems:

Line Length:

If possible, avoid long sample lines. In case of a long sample line, flow velocity can be increased by decreasing downstream pressure and using by-pass flow via a speed loop.

Sample Line Tubing Material:

- Use stainless steel tubing for noncorrosive streams.
- Ensure tubing is clean and free of grease (see Figure 3-7 for details).

CAUTION

Stream switching requires a sample pressure of 20 psig.

CAUTION

The calibration gas stream inlet is the last stream inlet following the sample gas.

Model 700 Upper Enclosure

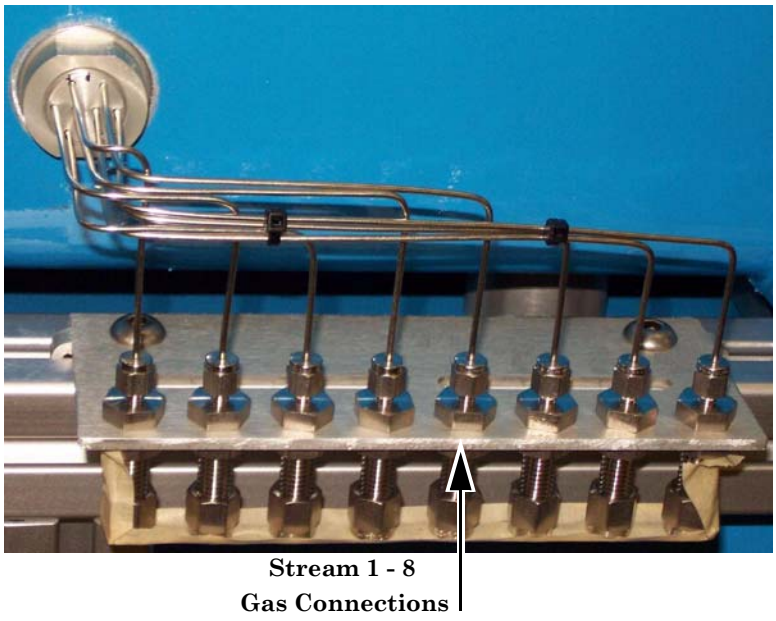


Figure 3-7 Stream Inlets (Right side of unit)

Dryers and Filters:

Use small sizes to minimize time lag and prevent back diffusion.

- Install a minimum of one filter to remove solid particles. Most applications require fine-element filters upstream of the GC. The Model 700 hardware includes a 2 micron filter.
- *Do* use ceramic or porous metallic type filters. *Do not* use cork or felt filters.

Pressure Regulators and Flow Controllers:

- *Do not* use types containing cork or felt filters, or absorbent diaphragms.

Pipe Threads, Dressing:

- *Do* use Teflon tape. *Do not* use pipe thread compounds (dope).

Valving:

- Install a block valve downstream of sample takeoff point for maintenance and shutdown.
- Block valve should be needle valve or cock valve type, of proper material and packing, and rated for process line pressure.

NOTICE

Install the probe/regulator first, *immediately* followed by the coalescing filter and then the membrane filter.

See Appendix C for a recommended natural gas installation.

3.2 PREPARATION

Your Model 700 GC was started and checked out before it left the factory. Program parameters were installed and documented in the PC Config Report furnished with your Model 700.

3.2.1 Site Selection

Install the GC as close as possible to the sample system but allow for adequate access space for maintenance tasks and adjustments. Allow a minimum of 14 inches (36 cm) in front for enclosure opening and access.

- Allow a minimum of 14 inches (36 cm) above the top of the dome enclosure for dome removal and access.
- Ensure that exposure to radio frequency (RF) interference is minimal.

3.2.2 Unpacking the Unit

See the following checklist for unpacking the unit and inspecting for damage:

1. Unpack the equipment:
   - Model 700 system
   - software and manuals
   - documentation package
2. Ensure that all documentation and software are included:
   - this manual Model 700 *Gas Chromatograph System Reference Manual* (P/N 3-9000-521)
   - the software manual, MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522)
   - diskette(s) or CD-ROMs with the MON2000 *Software for Gas Chromatographs Windows* software program, Modbus Test software program, and GC applications (P/N 2-3-2350-400)

3. Remove any packing materials from internal areas of the unit (particularly in the dome enclosure).

Installation and startup should proceed only if all required materials are on hand and free from obvious defects.

If any parts or assemblies appear to have been damaged in shipment, first file a claim with the carrier. Next, complete a full report describing the nature and extent of the damage and forward this report immediately to Measurement Services for further instructions (see the Customer Repair Report at the back of this manual). Include complete model number information. Disposition instructions will be returned immediately.

3.2.3 Model 700 Installation Arrangements

NOTICE

The wall should be strong enough to support the 200 lb. load.

The Model 700 GC can be ordered for installation in the following mounting arrangements (see drawing P/N DE-20993):

- wall mount
- pole mount
- floor mount

Wall Mount

The simplest arrangement is wall mount (see drawing P/N DE-20993). The unit has two mounting ears on each side. The ear-holes are used to attach the unit to a wall.

The uppermost of the holes should be about 30 inches from the floor for the most efficient use of the unit.

The space between the enclosures and the wall (1.3 inches) allows adequate access above and around the unit.

Pole Mount

The pole mount arrangement uses mounting ears as attachment points for the plates clamped to a pole (see drawing P/N DE-20993). The plates accept the recommended u-bolt systems for the 2 inch, 3 inch or 4 inch nominal pipe sizes. The base attachment of the pole being used must be able to accommodate the weight of the unit.

Floor Mount

The floor mount arrangement includes additional external framing that creates a free-standing unit (see drawing P/N DE-20993). The mounting ears, located on the base of the frame, are used to anchor the unit to a floor or instrument pad. The frame, also provides a means for attaching sample-conditioning plates or for anchoring tubing-runs.

3.2.4 Required Tools and Components

You will need these tools and components to install the Model 700:

- zero grade carrier gas (99.995% pure, with less than 5 ppm water, and less than 0.5 ppm hydrocarbons)
- high pressure dual-stage regulator for the carrier gas cylinder, high side up to 3000 pounds per square inch, gauge (psig), low side capable of controlling pressure up to 150 psig
- calibration standard gas with correct number of components and concentrations (see Appendix Table C-1)
- dual-stage regulator for the calibration gas cylinder, low pressure side capable of controlling pressure up to 30 psig

- sample probe regulator (fixture for procuring the stream, or sample gas for chromatographic analysis)
- coalescing filter
- membrane filter
- 1/8-inch stainless steel (SS) tubing for connecting calibration standard to GC, 1/8 inch SS tubing for connecting carrier gas to the GC, 1/8-inch SS tubing for connecting stream gas to the GC
- heat tracing (as required) for sample transport and calibration lines
- miscellaneous Swagelok tube fittings, tubing benders and tubing cutter
- 14 AWG (American Wire Gauge) (18 Metric Wire Gauge) or larger electrical wiring and conduit to provide 115 or 230 volts AC, single phase, 50 to 60 Hertz, from an appropriate circuit breaker and power disconnect switch (see guidelines in Section 3.1.2)
- liquid leak detector (Snoop or equivalent)
- digital volt-ohm meter with probe-type leads
- flow measuring device such as Set-A-Flow (P/N 4-4000-229)
- open-end wrenches sized 1/4, 5/16, 7/16, 1/2, 1/16 and 5/8-inch

3.2.5 Supporting Tools and Components

WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Do not use a PC or a printer in a hazardous area. Serial port and Modbus communications links are provided to connect the unit to the PC and to connect to other computers and printers in a safe area.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

Supporting tools and components include:

- Use an IBM-compatible PC and either a direct or remote communications connection to interface with the Model 700 system. See Section 2.1 of the MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for more information on specific PC requirements.
- The Model 700 comes with serial Port 2 on the Field Termination Board (FTB) factory-wired with a DB 9-pin connection. Use the provided serial cable (P/N 3-2350-068) to hookup to a PC. See Table A-4 for more information regarding these connections.

NOTICE

You can use the serial cable installed for the Model 700.

For straight-through serial cable installation and fabrication instructions, see Appendix A.

If a different serial cable is used to connect from the PC to the pre-wired DB 9-pin, follow these specifications:

Terminal	Connection
DB 9-pin male	Serial Port 2
DB 9-pin male DB 25-pin female	PC serial port

- Use items necessary for connecting the GC to a network or other type of remote data transfer system (an example item might be an RS-232/RS-485 conversion box for long distance serial transmission), as applicable.
- Use a printer, connected either at the PC or the GC unit, to record analysis and other data. See Section 3.4.6 for wiring information.

3.3 MODEL 700 INSTALLATION

3.3.1 DC Power Supply

WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Ensure that the 24 VDC input power source is switched OFF before connecting the wires. Also, ensure that the 24 VDC input power is S.E.L.V. compliant by suitable electrical separation from other circuits.

Failure to follow these warnings may result in injury or death to personnel or cause damage to the equipment.

CAUTION

DAMAGE TO EQUIPMENT

Check the unit prior to wiring to determine if it is equipped for DC power.

Failure to observe this precaution may damage equipment.

To connect 24 VDC power to the GC:

1. Locate the plug-together termination block inside the lower enclosure.

Model 700 Lower Enclosure

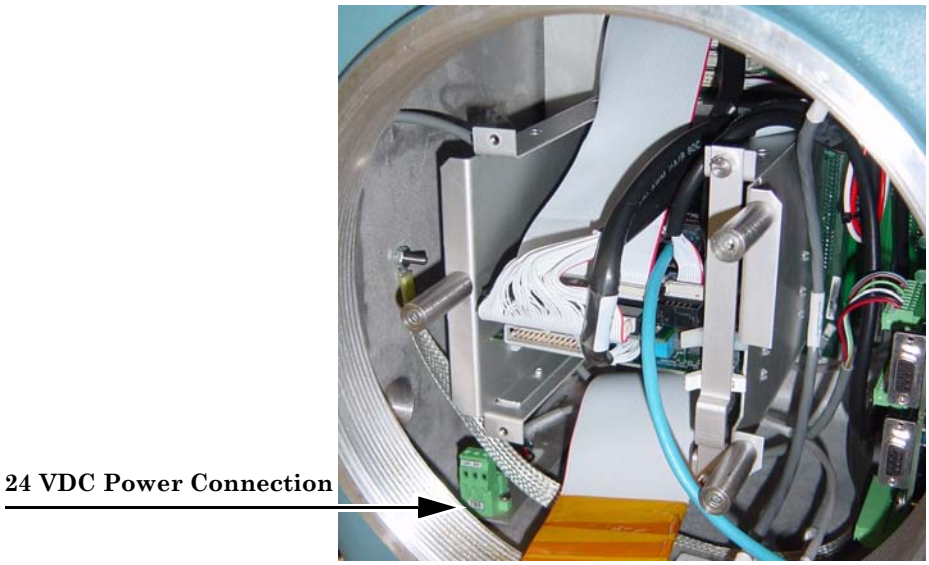


Figure 3-8 24 VDC Power Connection

2. Bring the two leads in through the entry on the left side of the lower enclosure. Connect to the termination plug provided with the unit. See Appendix D Drawing DE- 20993.

Model 700 Lower Enclosure

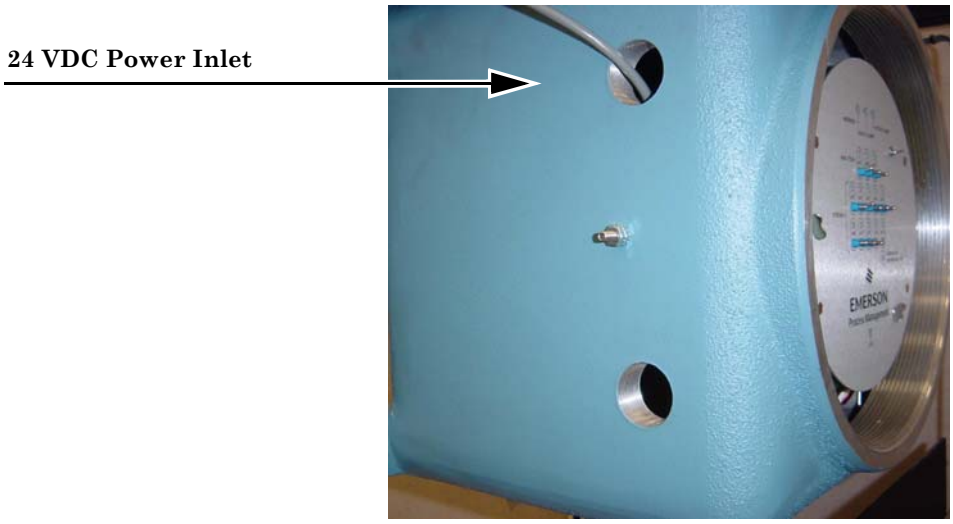


Figure 3-9 24 VDC Power Inlet

Use the following table for the DC power wiring details:

Table 3-2 DC Power Wiring

Attribute	Wire Color
+ (positive)	red
– (negative)	black

NOTICE

A new version of the Solenoid/Heater Driver Board that includes the Diode protection will soon be released.

3. Each board that connects to the 24 VDC is protected from lead reversal by the use of blocking diodes. The following boards are connected to the 24 VDC:
   - Field Termination Board
   - Isolated Analog Output Option Board
   - Solenoid/Heater Driver board
   - Micro-FID/TCD Preamplifier Board

   If the Red (+) and Black (-) leads are inadvertently reversed, no damage will occur, however, the system will not have power.
4. Connect the DC power leads to the power disconnect switch that is properly fused. The recommended fuse size is 10 Amps.

3.3.2 Optional AC – DC Power Converter

To connect 115 or 230 VAC power to the GC:

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Check the unit prior to wiring to determine if it is equipped for optional AC power.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

1. Locate the plug-together termination block inside the lower enclosure (located on the lower left side behind the power supply).

Model 700 Lower Enclosure

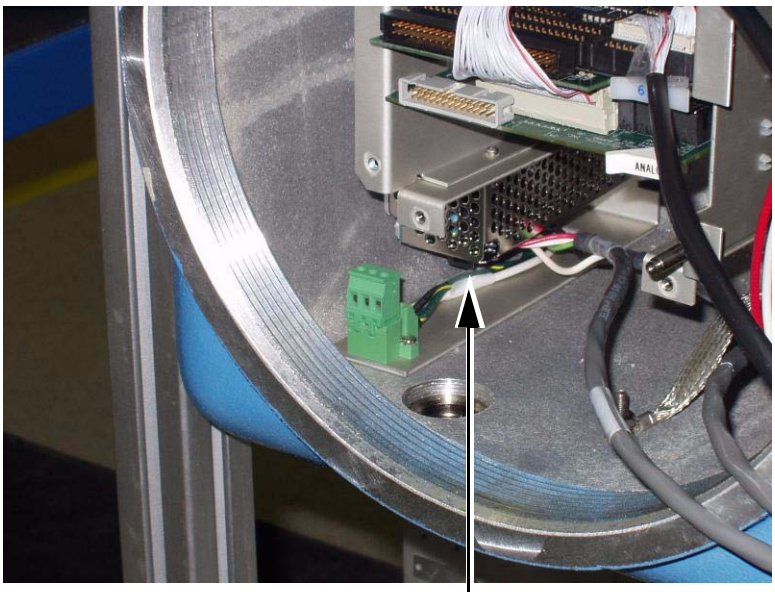


Figure 3-10 AC/DC Power Converter

WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Do not connect AC power leads without first ensuring that AC power source is switched OFF.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

CAUTION

DAMAGE TO EQUIPMENT

Do not apply electrical power to the GC until all interconnections and external signal connections have been verified, and proper grounds have been made.

Failure to observe this precaution may cause damage to equipment.

AC wiring is usually colored as:

Table 3-3 AC Wiring

Attribute	Wire Color
hot	brown or black
neutral	blue or white
ground	green or green

2. Bring the power leads in through the left entry on the bottom of the enclosure.
3. If necessary, connect the GC chassis ground to an external copper ground rod (at remote locations). See Section 3.1.5 regarding electrical and signal grounding.

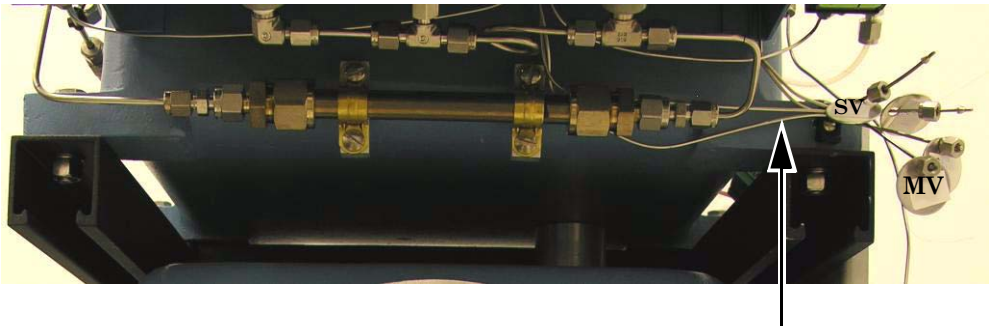
3.3.3 Sample and Gas Lines

NOTICE

Use SS tubing. Keep tubing clean and dry internally to avoid contamination. Before connecting the sample and gas lines, flow clean air or gas through them. Blow out internal moisture, dust, or other contaminants.

To install GC sample and gas lines:

1. Remove the plug from the Sample Vent (SV) line (1/16-inch tubing marked "SV" located on the Flow Panel Assembly).
   - If desired, connect the SV line to an external (ambient pressure) vent. If the vent line is terminated in an area exposed to wind, protect the exposed vent with a metal shield.
   - Use 1/4-inch or 3/8-inch tubing for vent lines longer than 10 feet.



Sample Vent and Measure Vent Lines

Figure 3-11 Model 700 Upper Enclosure

Note that, at this stage in the installation, the GC Measure Vent (MV) line (marked "MV") remains plugged until leak checks are completed. For regular operation, however, the MV line must be unplugged, or open.

Do not discard the vent line plugs. They are useful at any time when leak-checking the GC and its sample or gas line connections.

2. Connect carrier gas to the GC. (The carrier gas inlet is a 1/8-inch tee fitting located on the left side of the upper enclosure.)

CAUTION

MAY CAUSE INJURY TO PERSONNEL OR EQUIPMENT DAMAGE

Do not turn on gas until you have completed leak checking the carrier and sample lines (see Step 5).

Failure to follow this precaution may cause injury to personnel or damage equipment.

Model 700 Upper Enclosure

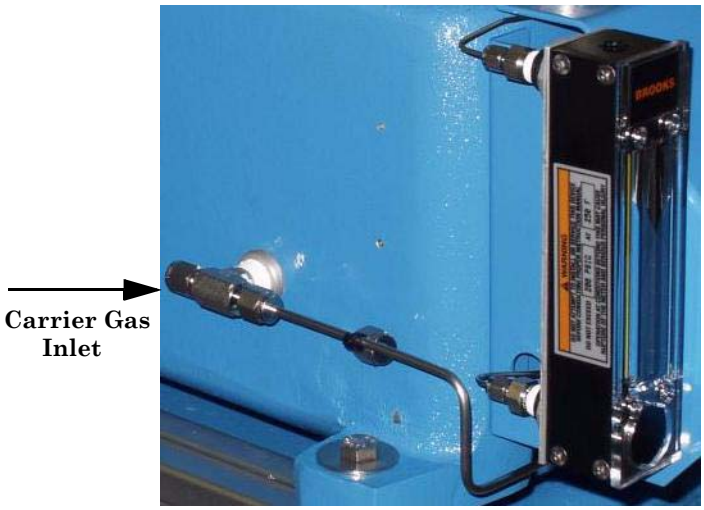


Figure 3-12 Carrier Gas Inlet Left-side Upper Enclosure

- Use 1/8-inch or 1/4-inch stainless steel tubing to conduct carrier gas.
- Use a dual-stage regulator with high-side capacity of 3000 psig and low-side capacity of 150 psig.

- See Appendix C for a description of a dual-cylinder carrier gas manifold (P/N 3-5000-050) with these features:.
  - Carrier gas is fed from two bottles.
  - When one bottle is nearly empty (100 psig), the other bottle becomes the primary supply.
  - Each bottle can be disconnected for refilling without interrupting GC operation.

NOTICE

The first stream is the calibration gas stream.

3. Connect calibration standard gas to the GC
   - Use 1/8-inch stainless steel tubing to conduct calibration standard gas.
   - Use a dual-stage regulator with low-side capacity of up to 30 psig.

NOTICE

When installing the calibration standard gas line, ensure that the correct tubing connection is made.

- The Calibration gas inlet is the last inlet following the sample gas (see Figure 3-13).

Model 700 Upper Enclosure

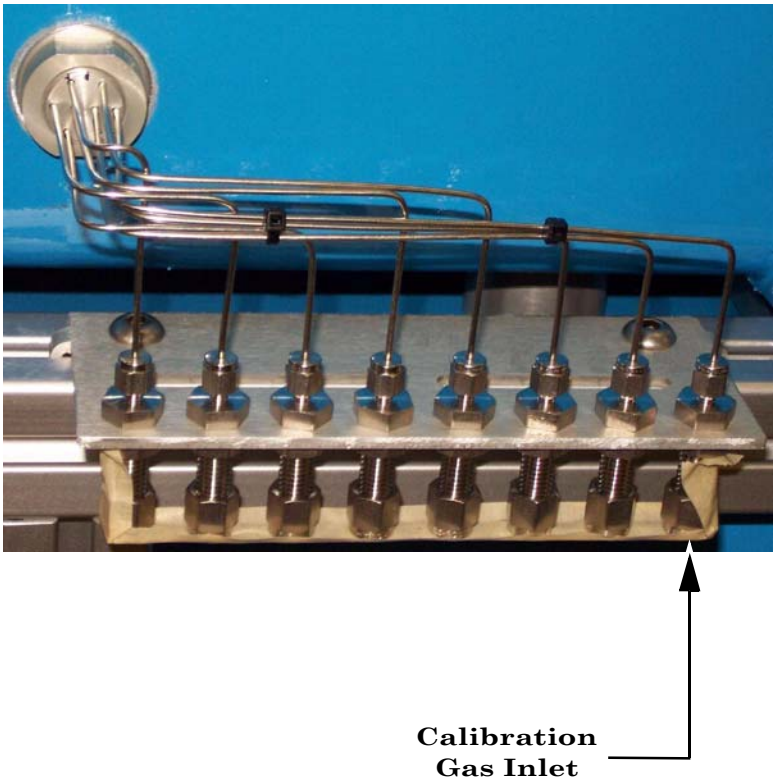


Figure 3-13 Calibration Gas Stream Inlet (Right side of unit)

4. Connect sample gas stream(s) to the GC (see Figure 3-11 Model 700 Upper Enclosure panel).
   - Use 1/8-inch or 1/4-inch stainless steel tubing to conduct calibration standard gas.
   - Ensure that pressure of sample line is regulated to maintain 15 to 30 psig (±10%).

- Gas stream inlet(s) are identified (see Figure 3-14) for details.

Model 700 Upper Enclosure

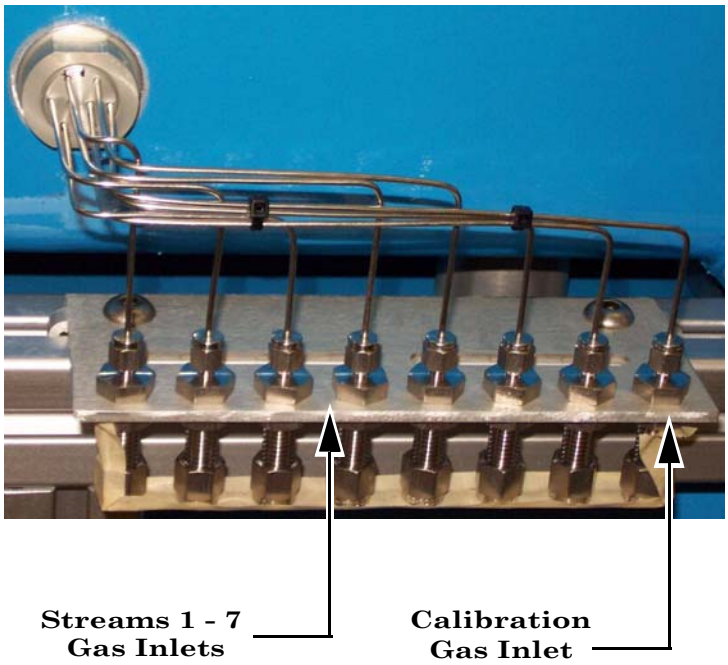


Figure 3-14 Sample Stream Inlets (Right side of unit)

5. After all lines have been installed, proceed with leak checking the carrier and sample lines. See Section 3.5.1; note that it requires the AC power to be turned on at the GC.

3.4 SETTING THE COM ID

NOTICE

Follow the steps in this section only if you wish to do the following:

- **Change the Com ID setting.**
- **Visually inspect and verify the DIP switch settings.**

The Model 700 Com ID is determined by dual inline package (DIP) switch settings.

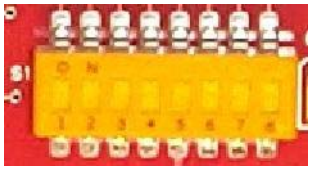


Figure 3-15 Dip Switch

In most cases, the Com ID configuration made at the factory will not need to be changed. The factory DIP switch settings produce a Com ID of 1.

3.4.1 Inspect or Change the Com ID

NOTICE

Note that the MON2000 software Com I.D.s will override the hardware settings. To use the hardware Com I.D. configuration, enter a zero '0' in the MON2000 Com I.D, settings. For details, refer to MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

To visually inspect and verify the DIP switch settings or to change the Com ID settings on the multifunction board,

1. Remove the dome from the upper enclosure.

CAUTION

MAY CAUSE INJURY TO PERSONNEL OR EQUIPMENTDAMAGE

Use caution when accessing an enclosure. A voltage of 115 to 230 VAC, along with various DC voltages, are present.

Failure to follow this precaution may cause injury to personnel or damage equipment.

2. Loosen the thumb screws on the Oven System mounting plate.

3. Carefully lift up the assembly and rotate so that the enclosure opening is accessible.

Model 700 Upper Enclosure

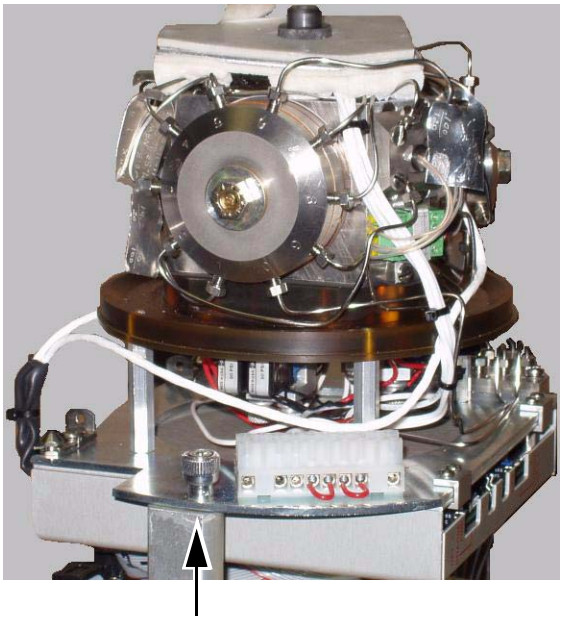


Figure 3-16 Oven Mounting Bracket

4. Locate the multifunction board. It is mounted on a bracket towards the center of the upper enclosure.

Model 700 Upper Enclosure

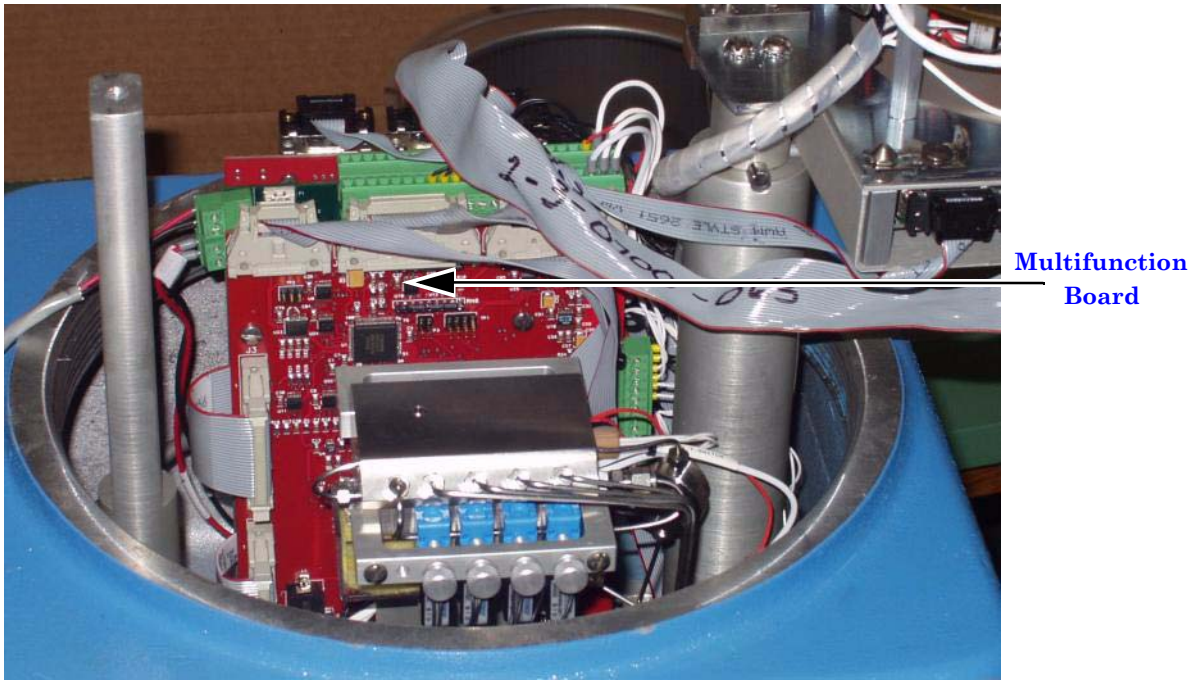


Figure 3-17 Multifunction Board Location

5. On the multifunction board, locate the Modbus slave address (Com ID) DIP switch. It is labeled "S1" and mounted on the lower right corner of the board.

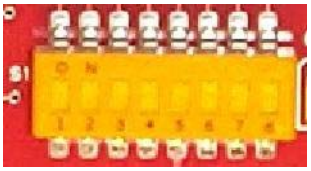


Figure 3-18 Dip Switch

6. Inspect or change the DIP switch as necessary, using the wiring diagram as a guide (see Table 3-4).

- Make settings on switch S1 located on the multifunction board.
- Switches “1” through “5” form a 5-bit binary number for setting the Modbus slave address (also known as *Com ID* or *Device ID).*
- Switch number “1” is the least significant bit, and switch number “5” is the most significant bit. Set these switches either ON or OFF.
- Switch “6” and “7” are spares and switch “8” is used to cold start the processor (see Table 3-5).

Use the GC maintenance records to document any changes made to the switch settings.

Table 3-4 Modbus Slave Address (Com ID) DIP Switch Settings

Com ID	1	2	3	4	5
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	SPARE				
7	SPARE				
8	COLD START				

Table 3-5 Switch Positions for Cold Start

	8
Normal (Run)	OFF
Cold Start	ON

3.4.2 Preparing for Serial Connections

The method for operating a Model 700 system is from a connected personal computer (PC). The PC must be:

- Running MON2000 software (version 2.2 or later). See the MON2000 *User Manual* (P/N 3-9000-522) for more information.
- Connected to the Model 700 via a serial link.

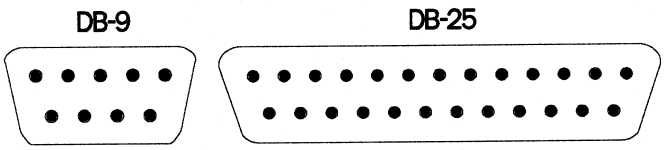
This section addresses the basic ways to wire a serial connection between a PC and the GC system.

Before connecting a PC to the Model 700, determine the following:

1. What serial ports are available at the PC?

   When you select one, consider these points:

   - Standard PC serial ports are type RS-232.
   - Usually there are two external serial port jacks on a PC, located on the rear panel. Most often, they are either DB-9 or DB-25 male (see below).



   - PC serial ports can be used by other peripheral equipment attached to the PC, such as a printer, mouse, or modem, etc.

     To determine which PC serial ports are already being used by other equipment and which port can be used for connecting to the GC, note existing serial connections, refer to your PC user manual, and use diagnostic software (such as Norton Utilities).

2. What serial ports are available at the GC? The Model 700 **without the** Micro-FID comes equipped with three serial ports (standard), unless the customer needs a LOI Interface connection, then only two com ports are standard. The installation of the optional Com4A board (with or without a LOI) brings the total number of available serial ports to six.

NOTICE

Model 700 software upgrades may be installed via any available Com Port.

When you select a serial port, consider these points:

- Com1 and Com2 from the WinSystems CPU board (J1) to Field Termination board (J5 and J7) (standard configuration)
- Com3 from WinSystems CPU board (J6) to the multifunction board
- Com4 is reserved for the LOI (Local Operator Interface), if installed.

The Model 700 **with the** Micro-FID comes equipped with two serial ports (standard). The installation of the optional Com4A board bring the total number of available serial ports to six.

When you select a serial port, consider these points:

- Com1 and Com2 from the WinSystems CPU board (J1) to Field Termination board (J5 and J7) standard configuration
- Com3 from WinSystems CPU board (J6) to the multifunction board (J4)
- Com4 from the WinSystems board (J6) is connected to the Micro-FID/TCD Preamplifier board (J4)

For additional serial ports, the:

- Optional Com4A board may be installed at the factory. Com5 through Com8 are fully available to the user and are factory-configured to RS-232 protocol. See Appendix A for additional options (RS-422/485).
- With the optional Com4A board installed, six Com ports are available to the user.

3. Is the connection to be made in a …
   - Short distance between the PC and GC?
   - With temporary or permanent cable connection?

   See Section 3.4.3, FTB Connection (RS-232).
4. Is the connection to be made with a …
   - Short distance between the PC and GC?
   - Permanent cable connection (see Section 3.4.4).
5. Is the connection to be made with a …
   - Long distance between the PC and GC?
   - Permanent cable connection (see Section 3.4.5).

3.4.3 FTB Connection (RS-232)

The easiest way to connect a PC to the GC is with an off-the-shelf, straight-through serial cable connected to the GC serial port DB 9-pin connector pre-wired on the FTB.

1. Obtain a straight-through serial cable with these specifications:
   - 50 feet long (or less)
   - DB 9-pin or DB 25-pin female plug at one end (for PC connection)
   - DB 9-pin male plug at the other end (for GC connection)
2. Connect the serial cable plugs to the appropriate serial port jacks at the PC and GC. Use the MON2000 software to monitor and operate the GC as needed.

NOTICE

You can buy this cable from most computer supply retailers.

If, however, it is necessary to custom-wire a cable because of circumstances, see guidelines provided in Appendix B.

NOTICE

For detailed information concerning serial communications, refer to Appendix A.

3.4.4 PC to GC Cable Short Distance Connection (RS-232)

The PC-GC connection is made with straight-through serial cable connected to one of the GC internal serial ports on the FTB.

If the length of cable can be 50 feet or less, connect the serial cable to one of the GC serial ports configured for RS-232. (Recall that output from a standard PC serial port follows RS-232 serial definition.) Cable that is longer than 50 feet, when used for RS-232 serial transmission, can result in spurious loss or corruption of data.

To connect your PC to one of the Model 700 serial port jacks:

1. Access the GC FTB (see Figure 3-19). located on the right wall of the lower enclosure.

Model 700 Lower Enclosure

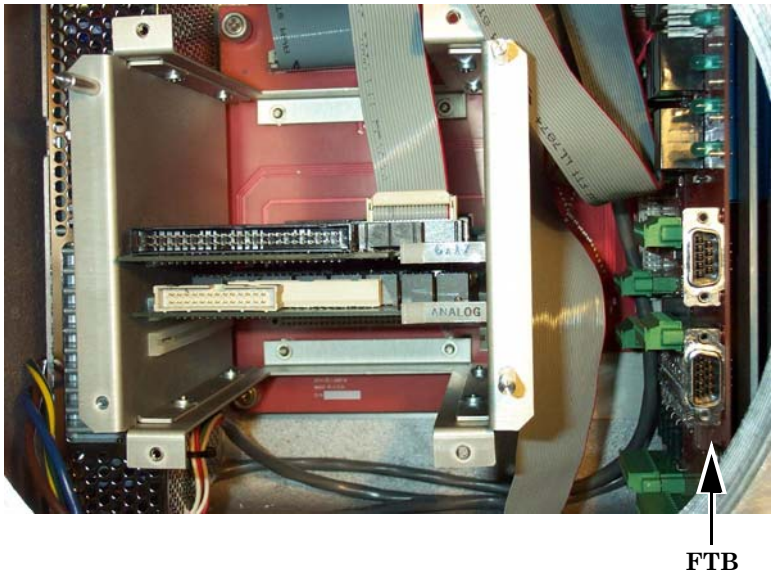


Figure 3-19 Field Termination Board

2. Choose an available serial port on the FTB (see P/N CE-21157 in Appendix D) that is configured for RS-232 protocol.

   Unless specified by the customer, serial ports are configured for RS-232.

   For further details, see Figure 3-20 and Figure 3-21.

NOTICE

Model 700, standard configuration, has two communications ports available on the FTB; Com1 and Com2.

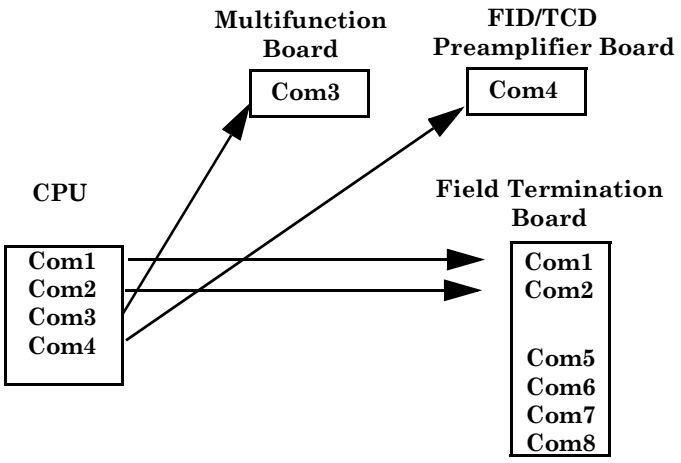


Figure 3-20 Configuration without Com4A Board

NOTICE

Com 4 is dedicated to the Micro-FID/TCD Preamplifier. When the LOI becomes available, it will use a video board instead of a serial port connection.

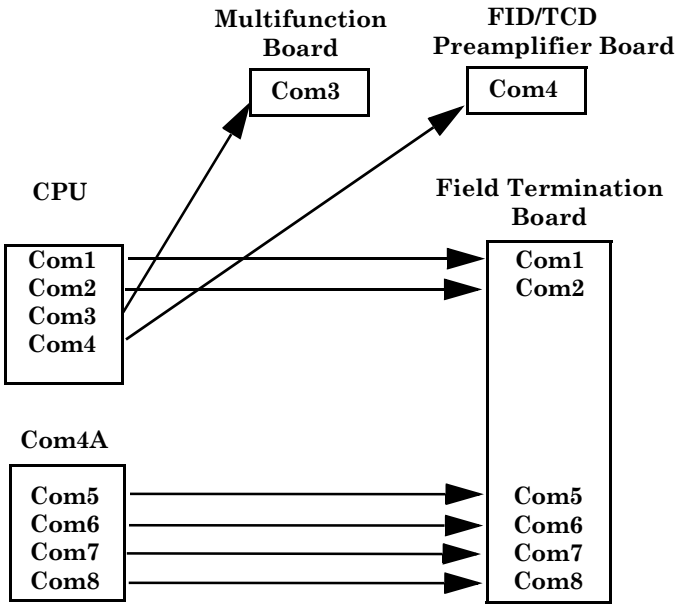


Figure 3-21 Configuration with Com4A Board

NOTICE

Model 700, with the Com 4A board installed, has six communications ports available on the FTB; Com1 and Com2, and Com5, Com6, Com7, and Com8.

NOTICE

Com 4 is dedicated to the Micro-FID/TCD Preamplifier. When the LOI becomes available, it will use a video board instead of a serial port connection.

NOTICE

See Appendix A for instructions on fabricating a direct serial cable.

3. Connect the appropriate serial cable.

   If using a direct 6 conductor serial cable, connect the exposed cable leads to the FTB serial port. A pinout of a female DB 9-pin socket is shown in Figure 3-22.

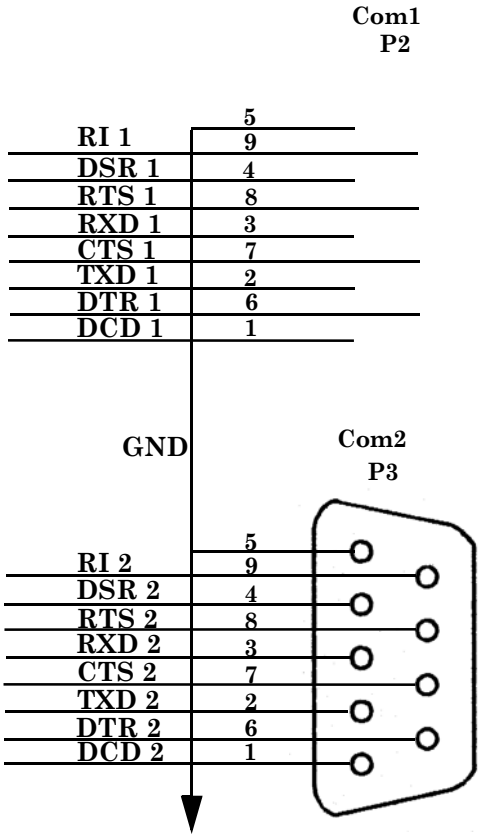


Figure 3-22 FTB Com1 and Com2 DB 9-pin Connector

4. Field Termination Board serial communications settings are shown in Figure 3-23 through Figure 3-27.

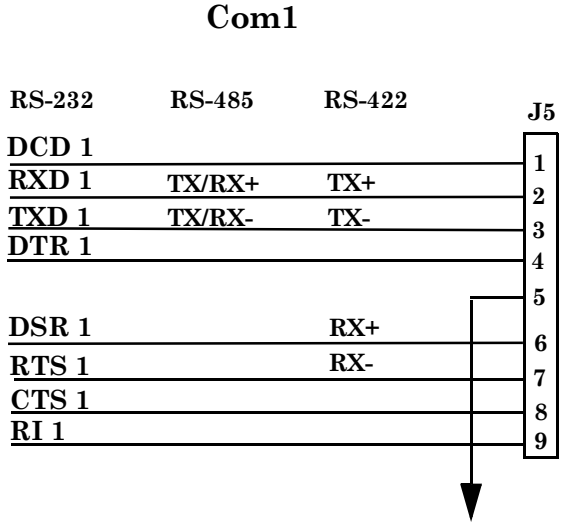


Figure 3-23 FTB Com 1 DB 9-pin Phoenix Connector

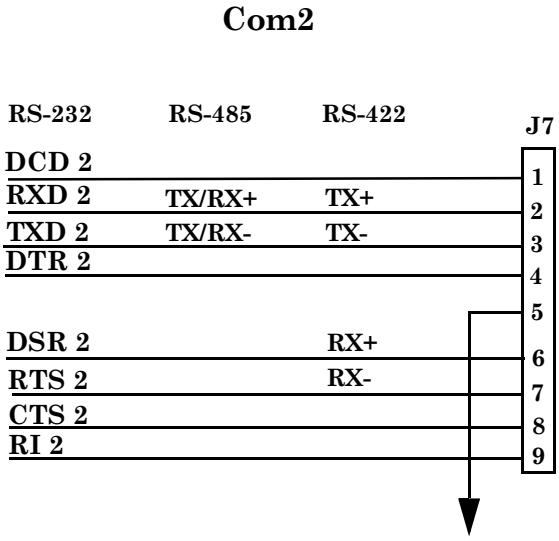


Figure 3-24 FTB Com2 DB 9-pin Phoenix Connector

Com5

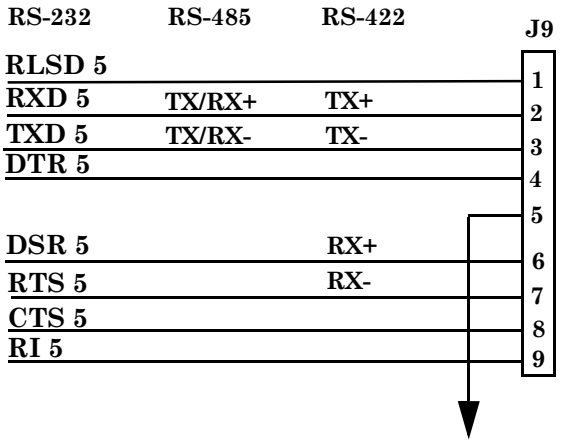


Figure 3-25 FTB Com5 DB 9-pin Phoenix Connector

Com6

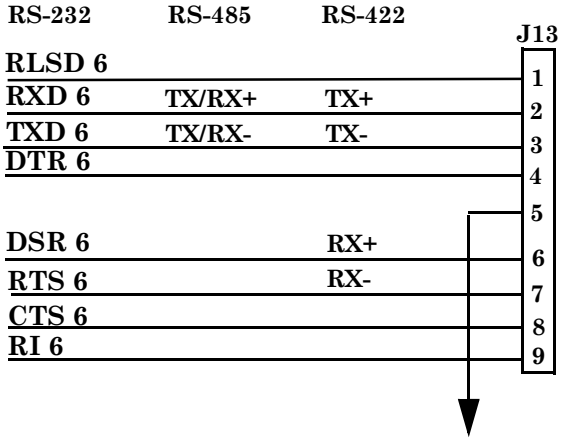


Figure 3-26 FTB Com6 DB 9-pin Phoenix Connector

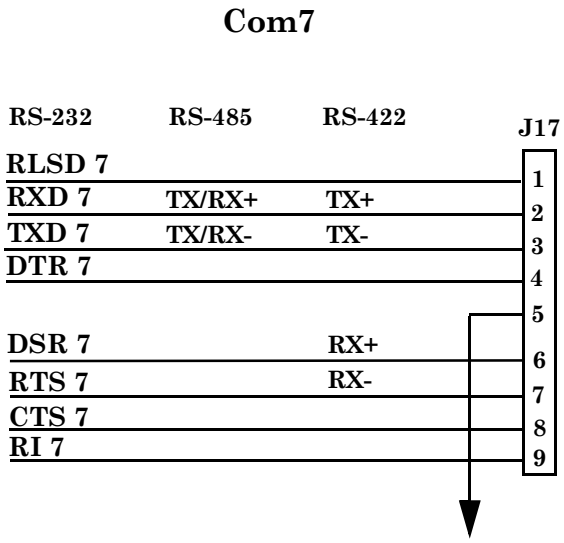


Figure 3-27 FTB Com7 DB 9-pin Phoenix Connector

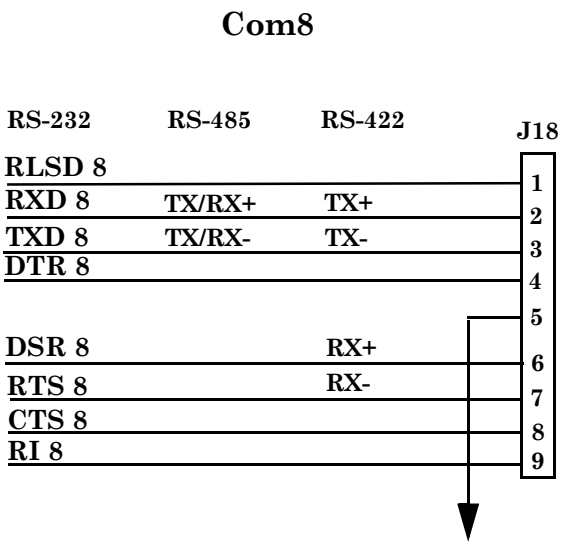


Figure 3-28 Com8 DB 9-pin Phoenix Connector
GC Phoenix Plug Port

To make an RS-232 serial connection between one of the Phoenix Plug serial ports of the GC, and an external modem with DB 25-pin serial port, you will need to manufacture the cable and its DB 25-pin, male plug cable end as illustrated below (see Figure 3-29).

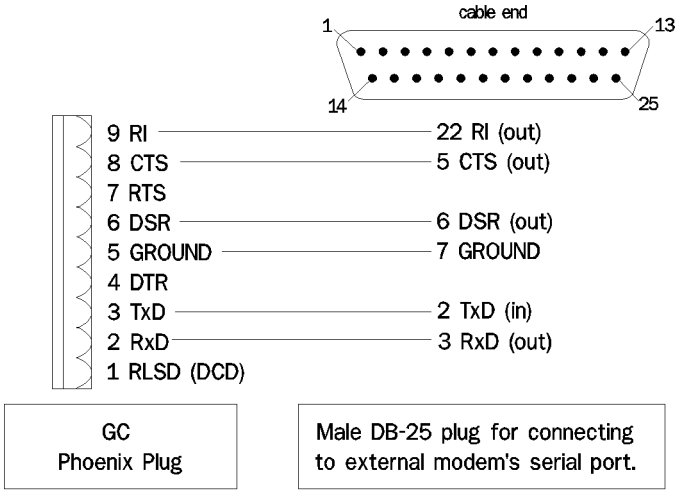


Figure 3-29 GC Phoenix Plug Port to External Modem DB 25-pin Port

3.4.5 Long Distance Connection (RS-422, RS-485)

RS-422 and RS-485 serial protocols are recommended for longer distance serial connections between the PC and GC System (i.e., distances greater than the 50 feet).

To connect your PC to one of the internal Model 700 RS-422/RS-485 serial port jacks:

5. Obtain the following equipment:
   - An asynchronous line driver (or interface device) with RS-232 input and RS-422/ RS-485 output. See Appendix A for example brand and model.
   - Shielded, computer-grade, twisted pair cable (to connect the asynchronous line driver device to the GC).
   - A straight-through serial cable (to connect the PC to the line driver).
6. Connect the straight-through serial cable from the PC serial port to the RS-232 serial port of the line driver device. Then connect the twisted pair cable to the RS-422/RS-485 serial port of the line driver.
7. Configure the line driver for data communications equipment (DCE) operation. See Appendix A for an example configuration.
8. Access the GC FTB (see Figure 3-19 in Section 3.4.2).
9. Choose an available serial port on FTB that is configured for RS-422 or RS-485 serial protocol, and connect the twisted pair cable from the line driver. See Appendix A for example connection. Also see Figure 3-23 through see Figure 3-27 for a list of ports and terminals assigned for serial communications.

NOTICE

Serial ports Com1 through Com3 are configured by default for RS-232.

For further details or instructions on how to configure these ports to RS-422/485, see Appendix A.

3.4.6 GC-Printer Wiring

NOTICE

The GC uses only a generic printer driver. The PC printer allows more control and better quality output.

A printer can be connected directly to the GC the Field Termination Board (FTB) at one of the serial ports. The type and scheduling of reports produced at the GC printer are determined by settings made in MON2000 (from the Reports menu, select GC Report Request and/or GC Printer Control; see the *MON2000 Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for more information).

To connect a printer to the GC serial port:

1. Access the GC FTB (see Figure 3-19 in Section 3.4.2).
2. Choose an available serial port on the FTB that is configured for RS-232 serial protocol.
3. After the wiring connections have been completed, use MON2000 to configure the GC serial port.
   (a) From the Application menu, select *Serial Ports*. The Serial Ports window appears.
   (b) Select the appropriate Port row and set *Usage* to "Report", *Protocol* to "ASCII" and *RW* to "W".
   (c) Ensure that the *Com ID* setting is correct.
   (d) Leave all other settings at the default values (see the MON2000 *User Manual* for more information).

NOTICE

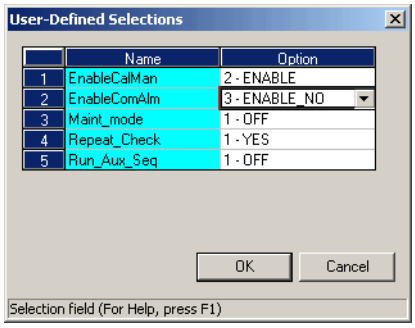
See Appendix A for a complete listing of the serial ports and corresponding pinouts to fabricate a serial printer cable.

3.4.7 Discrete Digital I/O Wiring

NOTICE

Configure the Digital Output using the MON2000 Software, from the *Application > User Defined > Selections*, set the enable the Common Alarm either Normally Open or Normally Closed.

The Field Termination Board (P/N 3-0700-010) has five discrete outputs and four discrete inputs. Refer to the *MON2000 Software for Gas Chromatographs Manual (P/N 3-9000-522)* and use the *Application>User Defined>Selection* menu to to configure the Digital Outputs.



Discrete Digital Inputs

To connect digital signal input/output lines to the GC (P/N 3-0700-010):

1. Access the FTB (see Figure 3-30) (P/N 3-0700-010).

Model 700 Lower Enclosure

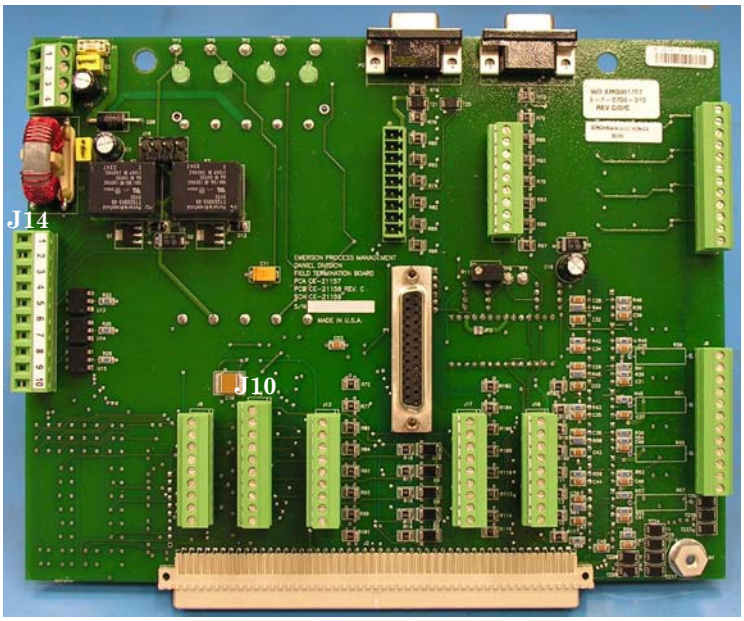


Figure 3-30 Field Termination Board

The FTB has five discrete outputs and four discrete inputs. The discrete input, DIG_IN4, is dedicated to a pressure switch.

The discrete inputs are located on J10 (10 pin Phoenix connector).

2. Route digital I/O lines appropriately, especially in the case of the explosion-proof enclosure.

   There are connections for four digital inputs and five digital output lines (Phoenix 10-pin connector), as follows:

Table 3-6 FTB Discrete Digital Inputs

J10	Function	Description
Pin 1	DIG_IN1	
Pin 2	GND	
Pin 3	DIG_IN2	
Pin 4	GND	
Pin 5	DIG_IN3	to customer
Pin 6	GND	
Pin 7	DIG_IN4	dedicated to a pressure switch
Pin 8	GND	dedicated to a pressure switch
Pin 9	DIG_IN5	
Pin 10	GND	

Discrete Digital Outputs

The discrete outputs are located on J14 (P/N 3-0700-010) (Phoenix 10-pin connector) have two “Form A” relays on the FTB. Outputs 3-5 are Solid State switches with a rating of .375A @30 VDC. The relays, with sealed enclosures, have a contact current rating of 1.0 Amperes each (see Figure 3-30).

For discrete digital outputs, see Table 3-7.

Table 3-7 FTB Discrete Digital Outputs

J14	Function
Pin 1	DIG_OUT
Pin 2	DIG_OUT
Pin 3	DIG_OUT
Pin 4	DIG_OUT
Pin 5	DIG_OUT_ 3+
Pin 6	DIG_OUT_ 3-
Pin 7	DIG_OUT_ 4+
Pin 8	DIG_OUT_ 4-
Pin 9	DIG_OUT_ 5+
Pin 10	DIG_OUT_ 5-

3.4.8 Analog Input Wiring

There are four analog inputs on the Field Termination Board (P/N 3-0700-010 and drawing CE-21157) located at J4 (12-pin Phoenix connector).

Table 3-8 FTB Analog Inputs

J4	Function
Pin 1	VIN+_1
Pin 2	VIN-_1
Pin 3	Shield
Pin 4	VIN+_2
Pin 5	VIN-_1
Pin 6	Shield
Pin 7	VIN+_3
Pin 8	VIN-_1
Pin 9	Shield
Pin 10	VIN+_4
Pin 11	VIN-_1
Pin 12	Shield

3.4.9 Analog Output Wiring

There are four standard analog outputs on the standard FTB (P/N 3-0700-010 and drawing CE-21157); located at J8 (12-pin Phoenix connector). Additionally, if installed, the optional analog board has eight analog outputs

Table 3-9 FTB Analog Outputs

J8	Function
Pin 1	IOUT+_1
Pin 2	IOUT-_1
Pin 3	Shield
Pin 4	IOUT+_2
Pin 5	IOUT-_2
Pin 6	Shield
Pin 7	IOUT+_3
Pin 8	IOUT-_3
Pin 9	Shield
Pin 10	IOUT+_4
Pin 11	IOUT-_4
Pin 12	Shield

There are eight analog outputs on the optional analog output board (P/N 2-3-0580-037 and drawing CE-21157); located at J3 (24-pin Phoenix connector):

Table 3-10 Optional Analog Outputs

J3	Function
Pin 1	IOUT+_5
Pin 13	IOUT-_5
Pin 2	Shield
Pin 14	IOUT+_6
Pin 3	IOUT-_6
Pin 15	Shield
Pin 4	IOUT+_7
Pin 16	IOUT-_7
Pin 5	Shield
Pin 17	IOUT+_8
Pin 6	IOUT-_8
Pin 18	Shield
Pin 7	IOUT+_9
Pin 19	IOUT-_9
Pin 8	Shield
Pin 20	IOUT+_10
Pin 9	IOUT-_10
Pin 21	Shield
Pin 10	IOUT+_11
Pin 22	IOUT-_11
Pin 11	Shield
Pin 23	IOUT+_12
Pin 12	IOUT+_12
Pin 24	Shield

3.4.10 Optional Boards

Optional modem boards are available for the Model 700 GC.

The jumper settings and pinouts for each board is shown below.

Optional WinSystems Modem

Table 3-11 J8 Modem Board Jumper Settings

Pin(s)	Position
1 and 2	In
3 and 4	In
5 and 6	In
7 and 8	In

Table 3-12 J9 Modem Board Jumper Settings

Pin(s)	Position
1 and 2	In
5 and 6	In

Table 3-13 J10 Modem Board Jumper Settings

Pin(s)	Position
1 and 2	In
3 and 4	In
5 and 6	In
9 and 10	In
15 and 16	In

Optional Radicom Modem Settings

Table 3-14 J26 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table 3-15 J27Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table 3-16 J30 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table 3-17 J31 Radicom Modem Jumper Settings

Pin(s)	Position
2 and 3	In

Ethernet Settings

Table 3-18 J1 PCM-NE2000 Ethernet Board Jumper Settings

Pin(s)	Position
15 and 16	In
17 and 18	In
21 and 22	In

Table 3-19 J2 PCM-NE2000 Ethernet Board Jumper Settings

Pin(s)	Position
1 and 2	In

Table 3-20 J3 PCM-NE2000 Ethernet Board Jumper Settings

Pin(s)	Position
1 and 2	In
7 and 8	In

3.5 LEAK CHECKS AND PURGING FOR FIRST CALIBRATION

Apply AC power to the unit after verifying all electrical connections are correct and safe. Ensure that all interconnections and external signal connections have been verified and proper grounds have been made before turning on the power.

3.5.1 Initial Leak Check

The focus of this section is for field connections to the analyzer, during the installation process. See Section 4.7 for an in depth discussion of analyzer leak checks.

Carrier Gas Line Leak Checks

NOTICE

The GC does not have an inline Block Valve to shut off the Carrier Gas flow.

1. Plug the Measure Vent (labeled "MV") to block the free flow of Carrier Gas through the GC.
2. *Slowly* pressurize the "GC side" of the Carrier Gas to 110 psig (±2 percent) with the dual-stage regulator at the Carrier Gas cylinder.
3. After two minutes, shut off the Carrier Gas bottle valve by turning it clockwise. Then, observe the high-side regulator gauge on the Carrier Gas bottle.
   - The gauge should not bleed down more than 200 psig in 10 minutes.
   - If Carrier Gas is lost at a faster rate, then all tube fittings between the Carrier Gas bottle and the GC (including the dual-stage regulator) must be checked for leaks and tightened if necessary.

Most leaks at this stage (Installation and Setup) are usually found between the Carrier Gas bottle and the GC.

The dual-stage regulator fitting connecting to the Carrier bottle, may not seat properly with some Carrier Gas bottles and allow a leak. If this occurs, carefully wrap a small length of Teflon tape around the tip of the inlet tube on the dual-stage regulator (which sits against the Carrier Gas bottle valve seat).

4. Once the GC passes the "Initial leak check", reopen the Carrier Gas bottle valve and remove the Measurement Vent (MV) plug.

Calibration Line Leak Check

1. Slowly pressurize the Calibration line (up to 20 psig).
2. Block-in the line by turning the "Cal Stream" blocking valve clockwise until seated.
3. Shut off the Calibration gas at the gas bottle by turning the valve clockwise.
4. Observe the high-side of the Calibration gas dual-stage regulator making sure the pressure holds. The pressure should not decrease for a period of two to three minutes.
5. When the GC passes the "Initial Calibration Gas leak check", re-open the Calibration gas bottle valve and the in-line "Cal Stream" block valve.

Sample Lines (Streams) Leak Check

1. Slowly pressurize the Sample line (up to 20 psig).
2. Block-in the line.
3. Observe the regulator, making sure the pressure holds. The pressure should not decrease for a period of two to three minutes.
4. When the GC passes the "Initial Sample Gas leak check", re-open the Sample Gas lines.

3.5.2 Purging Carrier Gas Lines

NOTICE

Tubing should be clean and dry internally. During installation, the tubing should have been blown free of internal moisture, dust, or other contaminants.

Purging carrier and calibration gas lines requires AC power.

To purge the Carrier Gas lines,

1. Ensure that the MV vent line plug has been removed, and the vent line is open.
2. Ensure that the Carrier Gas bottle valve is open.
3. Set the Carrier Gas line pressure at 110 psig. Use the dual stage regulator at the Carrier Gas bottle to adjust pressure.
4. Turn ON the AC power to the GC.
5. Establish communications with the GC via the MON2000 software. (Use the *File* > *Quick Connect* menu path; see Section 2.7.2 in the MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for more information.)

NOTICE

Do not use the "Carrier Pressure Adjust" regulator adjustment (on the Flow Panel Assembly) to adjust Carrier Gas line pressure. This pressure is factory-set and should not be adjusted.

6. Use the *Applications>Temperature Control menu path to access this function.* The readouts of the block, column and SSS heater controllers should indicate that the unit is warming up. Also, the yellow and red status indicators on the FTB4 should be on.
7. Allow the GC system temperature to stabilize and the Carrier Gas lines to become fully purged with Carrier Gas.
8. Select the Auto Sequence Function. Use the *Control > Auto Sequence* menu path described in Section 4 of the MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

NOTICE

A period of 4 to 8 hours (or overnight) is recommended, during which all of the settings described in Steps 1 through 7 are maintained. No other settings should be made.

3.5.3 Purging Calibration Gas Lines

To purge the calibration gas lines, as preparation for first calibration:

1. Ensure that the Carrier Gas lines have been fully purged, as described in the previous section, and that the SV plug has been removed.
2. Close the calibration gas bottle valve.
3. Fully open the block valve associated with calibration gas feed (the block valve should be located on lower right-hand corner of the front panel).

   See Section 5.8 in the MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for instructions on selecting streams.
4. Open the calibration gas bottle valve.
5. At the calibration gas bottle regulator, increase outlet pressure to 20 psig, ±5%.
6. Close the calibration gas bottle valve.
7. Let both gauges on the calibration gas bottle valve bleed down to 0 (zero) psig.
8. Repeat Steps 4 through 7, five times.
9. Open the calibration gas bottle valve.

3.6 SYSTEM STARTUP

To perform system start-up,

1. For system startup, run an analysis of the calibration gas.

   (a) If equipped with an optional stream switching board, ensure that the stream switch for the calibration stream is set to AUTO.

   Otherwise, ensure that the calibration gas supply is turned on and set to the correct pressure (25 to 30 PSIG).

   (b) Using the MON2000 software, run a single stream analysis on the calibration stream. Once proper operation of the GC is verified, halt the analysis.

   Use the *Control > Calibration and Control > Halt* menu paths; see Sections 4.3 and 4.4 in the MON2000 *Software for Gas Chromatographs User Manual (*P/N 3-9000-522*)* for more information.

2. Start Auto Sequence of the line gas stream(s).

   Use the *Control > Auto Sequence* menu path; see Section 4.1 in the MON2000 *Software for Gas Chromatographs User Manual (*P/N 3-9000-522*)* for more information. The GC will begin the Auto Sequence analysis mode.

MAINTENANCE AND TROUBLESHOOTING

4.1 HAZARDOUS ENVIRONMENTS

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Observe all precautionary signs posted on the Model 700 enclosure.

Failure to do so may result in injury or death to personnel or cause damage to the equipment.

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Observe all precautionary signs posted on the Model 700 enclosure.

The Model 700 enclosures are certified by CSA for Class I, Zone 1, AEx d IIB (+H2) T4 locations and are certified by SIRA for IEC Class I, Zone 1, EEx d IIC T4.

ATEX certified units must be installed strictly in compliance with the requirements of IEC 60079-14.

Special conditions for safe use must be met. The maximum constructional gap (i_c) is less than that required by Table 1 of IEC 60079-1:2004 as detailed in the Table 4-1 below.

Before opening the Model 700 assembly, reduce the risk of igniting hazardous atmospheres by disconnecting the equipment from all power supplies. Keep the assembly closed tightly when in operation to reduce the risk of igniting hazardous atmospheres.

Inlet (incoming) wiring must meet local standards (i.e. in conduit with seal fitting within 18" or via cable glands certified to IEC 60079-1). Seal all unused entries with blanks certified to IEC 60079-1.

Observe all precautionary signs posted on the Model 700 enclosure. Failure to do so may result in injury or death to personnel or cause damage to the equipment.

Please direct all health, safety and certification related questions to: Emerson Process Management, Gas Chromatographs, Applications Engineering Group, 713-827-6380 or 1-866-GC Center (1-866-422-3683).

Table 4-1 Flamepath Fitting Tube Gap Safety

FLAMEPATH	MAXIMUM GAP (MM)	COMMENT
Fitting tube adaptor/fitting tube taper	0.000	Taper fit
Fitting tube/taper/tubes	0.132	

4.2 TROUBLESHOOTING AND REPAIR CONCEPT

The most efficient method for maintaining and repairing the Model 700 GC system is a component-replacement concept that allows you to return the system to operation as quickly as possible. Sources of trouble, such as printed-circuit assemblies, valves, etc., are identified during troubleshooting test procedures and are replaced at the lowest level practical with units in known working order. The defective components are then either repaired in the field or returned to Measurement Services for repair or replacement.

4.3 ROUTINE MAINTENANCE

The Model 700 GC system will perform accurately for long periods with very little attention (except for maintaining the Carrier Gas cylinders). A bimonthly record of certain parameters will assist greatly in assuring that your Model 700 is operating to specifications. The maintenance checklist should be filled out bimonthly, dated, and kept on file for access by maintenance technicians as necessary (see Table 4-2).This gives you a historical record of the operation of your Model 700, enables a maintenance technician to schedule replacement of gas cylinders at a convenient time, and allows quick troubleshooting and repair when it becomes necessary.

A chromatogram, a Configuration Report, and a Raw Data Report should also be made and filed with the checklist, furnishing a positive dated record of the Model 700. The chromatogram and reports can also be compared to the chromatograms and reports run during the troubleshooting process.

4.3.1 Bimonthly Maintenance Checklist

Copy the sample maintenance checklist as necessary for your files (see Table 4-2). If you have a problem, please complete the checklist and reports, and have the results available when calling Measurement Services with a problem. Also have the Sales Order number. The Sales Order number can be found on the nameplate located on the left side wall of the upper housing of the Model 700. The chromatograms and reports archived when your Model 700 left the factory are filed by this number.

Table 4-2 Maintenance Checklist

Date Performed:	**Sales Order Number:**		
System Parameters	**As Found**	**As Left**	**Nominal**
Carrier Gas Cylinder			
Cylinder Pressure Reading (High)	____ psig	____ psig	____ psig
Cylinder Pressure Outlet Reading	____ psig	____ psig	110 psig
Carrier Pressure Panel Regulator	____ psig	N/A	85 psig
Sample System			
Sample Line Pressure(s)	(1)____ psig	____ psig	20 psig
	(2)____ psig	____ psig	20 psig
	(3)____ psig	____ psig	20 psig
	(4)____ psig	____ psig	20 psig
	(5)____ psig	____ psig	20 psig
Sample Flows	(1)___ cc/min	____cc/min	40-60 cc
Sample Vent 1 (SV1)	(2)___ cc/min	____cc/min	40-60 cc
Sample Vent 2 (SV2)	(3)___ cc/min	____cc/min	40-60 cc
	(4)___ cc/min	____cc/min	40-60 cc
	(5)___ cc/min	____cc/min	40-60 cc
Calibration Gas			
High Pressure Reading	____ psig	____ psig	
Outlet Pressure Reading	____ psig	____ psig	20 psig
Flow	____ cc/min	___ cc/min	40-60 cc

4.3.2 Routine Maintenance Procedures

- Complete the maintenance checklist bi-monthly. Place the sales order number, date, and time on the form and file it. This gives you a basis for comparison in the future if you need it.
- Save a Chromatogram of the operating Model 700 on the PC with the MON2000 software. Print Configuration, Calibration, and Raw Data reports and file them with the MON2000.
- Check the printer paper (if used) to ensure that a sufficient supply of paper remains. Check carrier and calibration gas supplies.

4.3.3 Contact Service

Measurement Services offers maintenance service programs that are tailored to fit specific requirements. Contracts for service and repair can be arranged by contacting Measurement Services at the address or telephone number on the Customer Repair Report at the back of this manual.

4.4 ACCESS TO GC EQUIPMENT ELEMENTS

4.4.1 Electrical/Electronic Components

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

The explosion-proof housing should not be opened when the unit is exposed to an explosive environment. If access to the explosion-proof housing is required, precautions must be taken to ensure that an explosive environment is not present.

Failure to do so may result in injury or death to personnel or cause damage to the equipment.

The Model 700 electrical/electronic components are located in the upper and lower explosion-proof housings. All of the electrical/electronic components are fully accessible from the front and top of the Model 700.

Model 700 Micro-FID Assembly

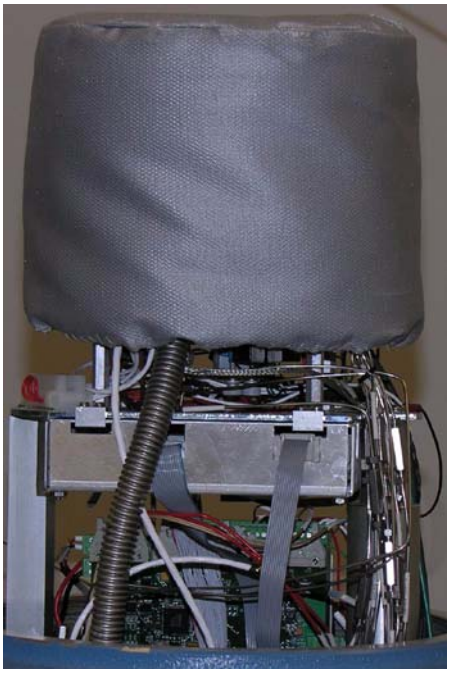


Figure 4-1 Model 700 with TCD/Micro-FID Front View

Model 700 with TCD Upper Enclosure

- Multifunction Board
- Dual Methods Adapter Board
- Dual Methods Preamplifier Board
- Solenoid Heater/Driver Board

Model 700 with TCD Lower Enclosure

- WinSystems CPU Board
- Analog Board
- Analog Board (optional)
- Com4A Board (optional)
- Ethernet Board (optional)
- Radicom Modem board (optional)
- DC/DC Field Termination Board

Model 700 with Micro-FID/TCD Upper Enclosure

- Multifunction Board
- Solenoid/Heater Driver Board
- Micro-FID/TCD Preamplifier Board
- Micro-FID/TCD Preamplifier Power Supply Board
- Micro-FID Connector Board

Model 700 with Micro-FID/TCD Lower Enclosure

- Field Termination Board
  - Backplane Board
  - Interconnect Board

- WinSystems CPU (with PC104 interface)
- Com4A PC/104 Board (optional)
- Ethernet Board (optional)
- Radicom Modem Board (optional)
- Eight Channel Analog (non-isolated 4-20mA) Output Board (optional)
- Four Channel Analog (isolated 4-20mA) Output Board (optional)
- Front Panel Analytical and Stream Switch Panel
- Dual Methods Adapter Board

NOTICE

The optional Radicom Modem is always mounted on top of the PC//104 card stack.

Model 700 Lower Enclosure Electronics

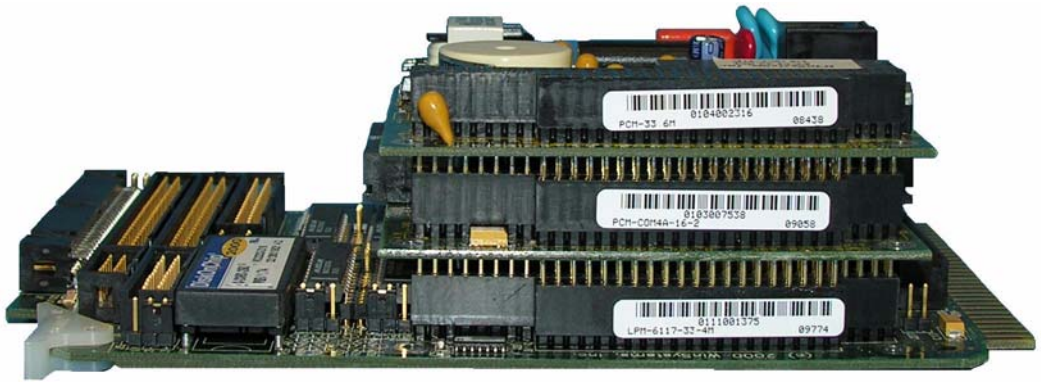


Figure 4-2 CPU, Com4A, and Modem Boards

4.4.2 Detector Elements, Heater Elements, Valves and Columns

The detector elements, heater elements, valves and columns are located in the upper explosion-proof housing of the Model 700 GC.

NOTICE

The optional Ethernet board is not shown, but plugs into the CPU board or the Com4A board.

Remove the thermal cover and insulating shield to gain access to these components.

Model 700 Upper Enclosure

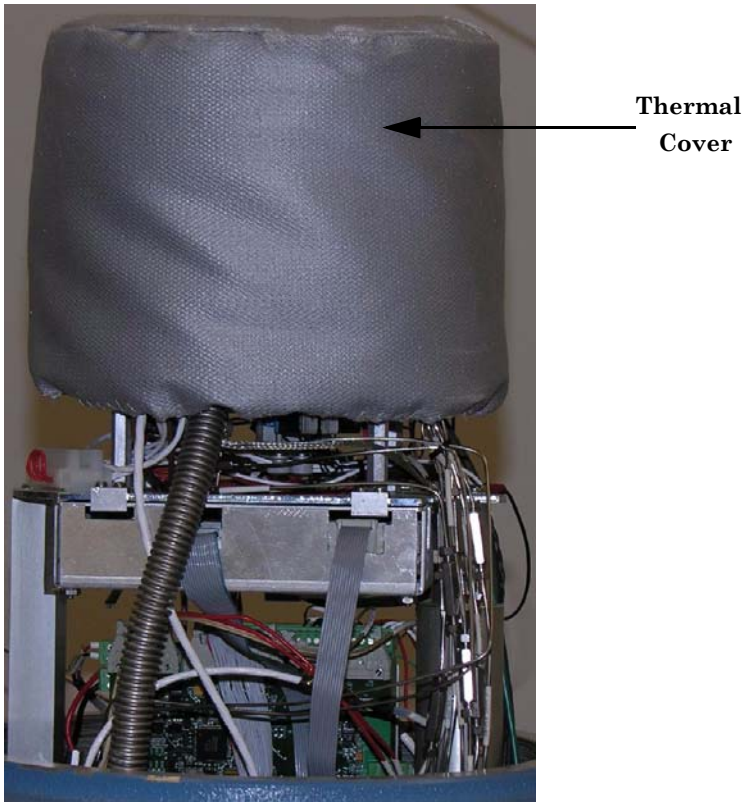


Figure 4-3 Upper Explosion-proof Housing

The detector elements, including the Micro-FID, are located in the block (TCD) and on the Micro-FID Base attached to the valve block.

Model 700 TCD Upper Enclosure

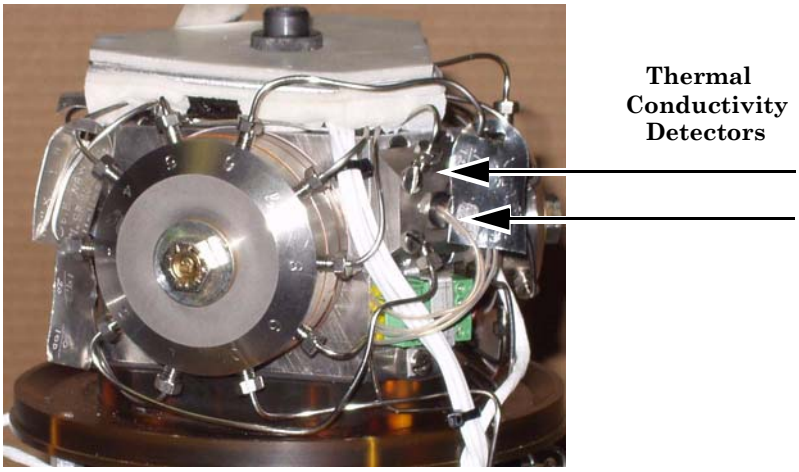


Figure 4-4 Thermal Conductivity Detector

Model 700 Micro-FID Upper Enclosure

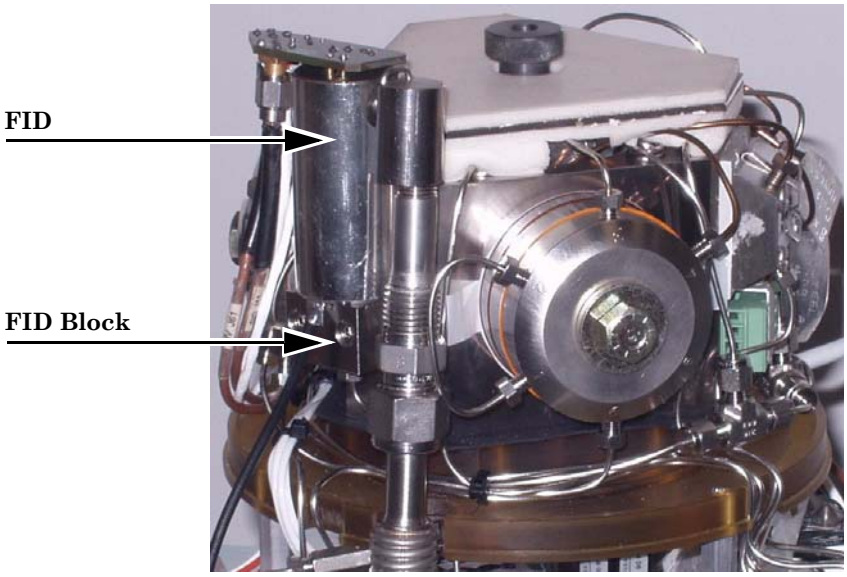


Figure 4-5 Flame Ionization Detector

There are five heater elements: three valve block heaters, the column heater, and the stream switching system heater (see Figure 4-4).

The stream switching heater is a cartridge heater inserted into the stream switch block (manifold).

The column heater is a cartridge heater located in the middle of the column mandrel.

The block heaters are cartridge heaters located in the corners of the block. Column and block heaters are identical and are installed from the underside of the manifold (plastic base) of the oven.

4.5 PRECAUTIONS FOR HANDLING PC ASSEMBLIES

Printed circuit assemblies contain CMOS integrated circuits, which can be damaged if the assemblies are not properly handled. The following precautions must be observed when working with the assemblies:

- Do not install or remove the Model 700 printed circuit assemblies while power is applied to the units.
- Keep electrical components and assemblies in their protective (conductive) carriers or wrapping until ready for use.
- Use the protective carrier as a glove when installing or removing printed circuit assemblies.
- Maintain contact with a grounded surface to prevent static discharge when installing or removing printed circuit assemblies.

NOTICE

Correct ALL alarms before re-calibration.

4.6 GENERAL TROUBLESHOOTING

This section contains general troubleshooting information for the Model 700. The information is arranged as appropriate either by major subsystems or by major functions of the instrument. See Table 4-3 for frequent possible causes of the hardware alarms.

4.6.1 Hardware Alarms

Use the following table to identify the alarm and possible cause to remedy the problem.

Table 4-3 Basic Hardware Troubleshooting via Alarms

Alarm	Possible Cause
Application Checksum Failure	DiskOnChip
ROM Checksum Failure	DiskOnChip
RAM Diagnostics Failure	bad RAM
Micro-FID/TCD Preamplifier Alarms Micro-FID Temperature High Micro-FID Comm. Failure	extinguished flame
Analog Output 1 High	Measured value program for Analog Output 1 is greater than user-defined full scale range.
Analog Output 2 High Analog Output 3 High Analog Output 4 High Analog Output 5 High Analog Output 6 High Analog Output 7 High Analog Output 8 High Analog Output 9 High Analog Output 10 High Analog Output 11 High Analog Output 12 High	same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High same as Analog Output 1 High
Analog Output 1 Low	Measured value program for Analog Output 1 is lower than user-defined zero range.

Table 4-3 Basic Hardware Troubleshooting via Alarms (Continued)

Alarm	Possible Cause
Analog Output 2 Low	same as Analog Output 1 Low
Analog Output 3 Low	same as Analog Output 1 Low
Analog Output 4 Low	same as Analog Output 1 Low
Analog Output 5 Low	same as Analog Output 1 Low
Analog Output 6 Low	same as Analog Output 1 Low
Analog Output 7 Low	same as Analog Output 1 Low
Analog Output 8 Low	same as Analog Output 1 Low
Analog Output 9 Low	same as Analog Output 1 Low
Analog Output 10 Low	same as Analog Output 1 Low
Analog Output 11 Low	same as Analog Output 1 Low
Analog Output 12 Low	same as Analog Output 1 Low
Analog Input High 1	Measured value program for Analog Input 1 is greater than the user-defined full scale range.
Analog Input High 2	Same as Analog Input 1 High
Analog Input High 3	Same as Analog Input 1 High
Analog Input High 4	Same as Analog Input 1 High
Analog Input Low 1	Measured value program for Analog Input 1 is lower than the user-defined full scale range.
Analog Input Low 2	Same as Analog Input 1 Low
Analog Input Low 3	Same as Analog Input 2 Low
Analog Input Low 4	Same as Analog Input 3 Low
Preamp Input 1 Out of Range	Indicates either Carrier Gas gone; air not purged from carrier lines; power failure; bad thermistors; preamp out of balance or failed; analyzer temperature low; interconnection wiring.
Preamp Input 2 Out of Range	same as Preamp Input 1 Out of Range
Preamp Input 3 Out of Range	same as Preamp Input 1 Out of Range
Preamp Input 4 Out of Range	same as Preamp Input 1 Out of Range
Preamp Failure	same as Preamp Input 1 Out of Range
Analyzer Failure	Indicates either the Carrier Gas is low (below 90 psig at Carrier Gas bottle) or gone; a bad solenoid; a Carrier Gas leak in system.

Table 4-3 Basic Hardware Troubleshooting via Alarms (Continued)

Alarm	Possible Cause
Power Failure	GC Controller has experienced a re-start since alarms were last cleared, caused by power failure. Automatically starts in RUN mode and runs calibration gas until it identifies all retention times or for a maximum of two hours before switching to line gas.
TCD Fused Peak Overflow - Noisy Baseline	Air not purged from carrier lines; bad thermistors; shields.
RF% Deviation	Calibration gas low or out; valve timing error; faulty auto-calibration solenoid.
Warm Start Calibration Failure	same as RF% deviation
Valve Timing Failure	same as RF% deviation

4.6.2 Troubleshooting Checklist

An online gas chromatograph can operate properly only if flows are balanced and constant, the temperature is constant, no leaks are present, and the GC Controller is correctly timed. Before going through the troubleshooting procedures, perform the routines of the Basic Hardware Troubleshooting via Alarms (see Table 4-3). Checklist records performed regularly may indicate problems and prevent any sudden breakdown.

NOTICE

Use the Mon2000 software in the offline mode and select *Logs>Parameter List* from the drop-down menu and open a saved *.par file.

Compare current values with those in the saved Parameter list.

Use the Mon2000 software in the offline mode and select *Logs>Parameter List* from the drop-down menu and open a saved *.par file. Do not adjust any values if they are within the nominal tolerance values on the Checklist. Compare the values with those obtained in preceding weeks. This may pinpoint your problem immediately.

The following is a guide for troubleshooting if a problem with sample analysis occurs. See Table 4-3 for diagnostic data. This data will be useful if it becomes necessary to call Measurement Services for assistance.

Table 4-4 Troubleshooting Checklist

Description	As Found	As Left	Notes
Analyzer			
Leak check with "Snoop" from Carrier Gas bottle to Analyzer regulator.			
Leak check with "Snoop" from calibration standard to auto-calibration solenoid.			
Pre-amp balance voltage	_____mV	_____mV	0 (±0.5 mV)
Sample System			
Leak check with "Snoop" from sample probe to sample solenoid			
Controller Inputs			
GRI (CH.1) 0.0 - 0.0			
GRI (CH.2) 0.8 - 1.2			
GRI (CH.3) 0.8 - 1.2			
GRI (CH.4) 0.8 - 1.2			
	_____	_____	4800 to 6400
Value (12-bit AD)	_____	_____	4800 to 6400
PAZ1	_____	_____	4800 to 6400
PAZ2	_____	_____	9200 to 12000
PAZ3			
PAZ4			
	_____	_____	-32767 to 32767
Value (16-bit AD)	_____	_____	-32767 to 32767
GC 1	_____	_____	-32767 to 32767
GC2	_____	_____	-32767 to 32767
GC3			
GC4			

Table 4-4 Troubleshooting Checklist (Continued)

Description	As Found	As Left	Notes
Power Supply (DC – DC) Input Voltage Ranges: (23V - 28VDC)			**NOTE: See Figure 4-6 through Figure 4-9 for test point locations.** **FTB:** + 12V @ 0.25A (± 0.6) + 5V @ 3A (± 0.25V) - 3.8V @ 0.1A (± 0.2V) - 12 V @ 0.25A (C 0.6V) **Dual Methods Adapter** + 20V @ 0.35A (± 1V) - 20V @ 0.35A (± 1V) + 5VDC (± 0.25V) **NOTICE** **The Dual Methods Board is used on Model 700 GCs with 2350A Controllers.**
Power Supply (AC – DC) Input Voltage Range: (90–130/180-264 VAC) (Auto-ranging)			**SOL/HTR Driver** N/A **Output Voltage/Current:** 24.0VDC **Output Power:** Continuous load demand power, measured at the Output Terminals of the Power Supply, **shall not** exceed 140 Watts.

Table 4-4 Troubleshooting Checklist (Continued)

Description	As Found	As Left	Notes
Chromatogram			
Check baseline			
Check component values on report			
Number of peaks			
Retention times			
Date and file			
Temperature			
Column Module Temperature	____ °C ____ °F	____°C ____°F	79.80 - 80.20 °C 175.64 - 176.36 °F
Valve Block Temperature	____°C ____°F	____ °C ____ °F	79.80 - 80.20 °C 175.64 - 176.36 °F
Stream Switching System	____ °C ____ °F	____ °C ____ °F	64.0 - 66.0 °C 147.2 - 150.8 °F
Sample System Temperature	____ °C	____ °C	**
Measure Vent Flow			
Valve 3 ON Valve 3 OFF	___ cc/min ___ cc/min	____ cc/min ____ cc/min	Flow should be as specified on the Parameter List for the particular GC (from MON2000 use *Logs>Parameter List* menu path to access the list). Check the flow using a portable electronic flow meter or a mechanical flow meter like a Set-a-Flo. If a Rotameter™ is permanently installed it will cause baseline noise.

**Refer to System Operational Parameters

4.6.3 Test Points Dual Methods Board and FTB

This section applies to Model 700 GCs with the TCD and 2350A Controllers. If your Model 700 GC is equipped with an Micro-FID or LSIV this section does not apply.

Use the test points in Figure 4-6 through Figure 4-9 to ensure that the voltage meets specifications on the Dual Methods Adapter Board and the Field Termination Board (see Table 4-4 for voltage specifications).

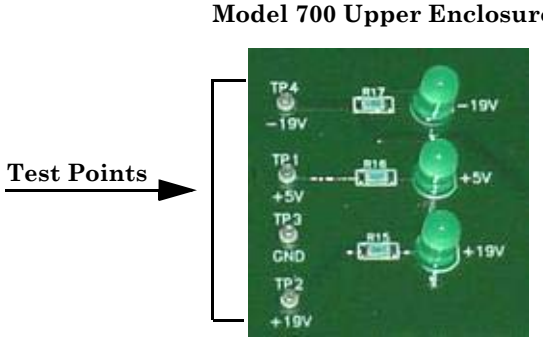


Figure 4-6 Test Points Dual Methods Board (Cut View)

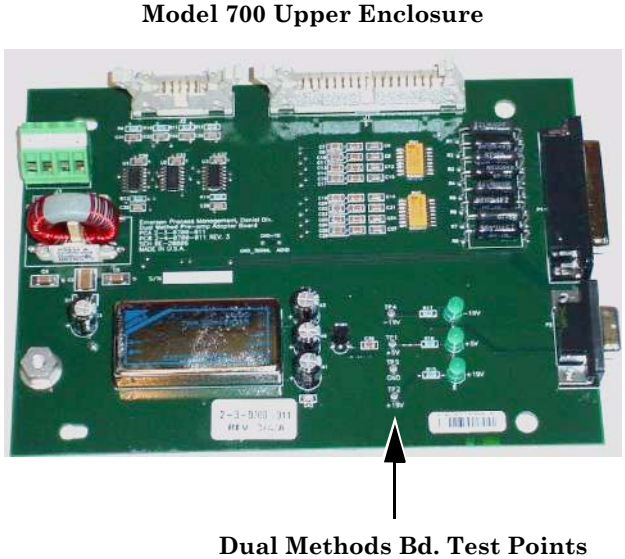


Figure 4-7 Test Points Dual Methods Board

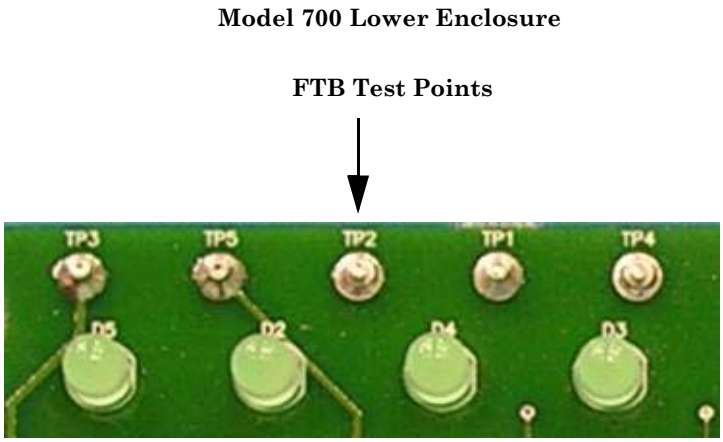


Figure 4-8 Test Points Field Termination Board (Cut View)

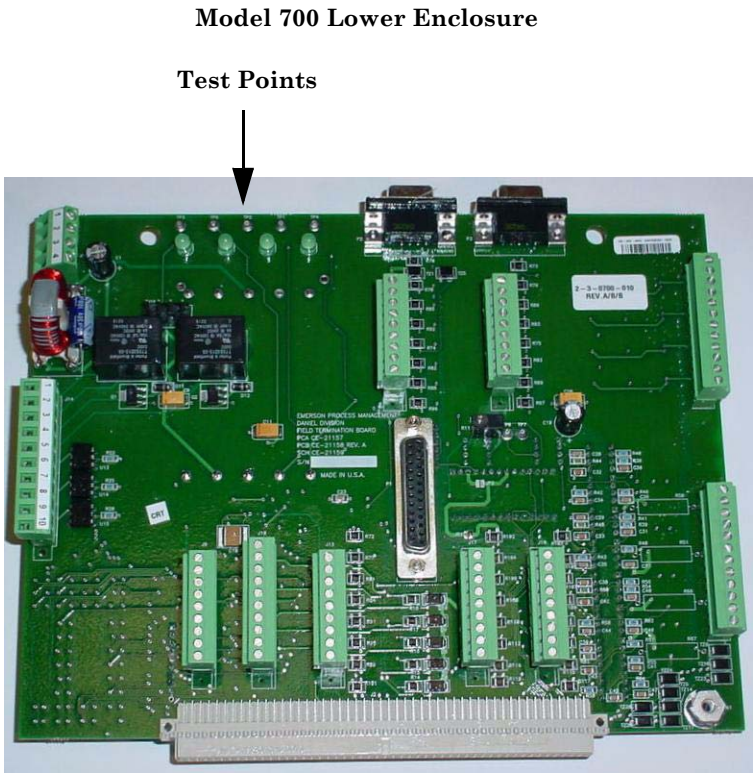


Figure 4-9 Test Points Field Termination Board

4.6.4 Preamplifier

The preamplifier (P/N 3-0580-002) has no parts that may be serviced in the field. If the unit fails, return it to Measurement Services for repair or replacement.

4.6.5 Flow Balance Check

Ensure that the flow panel gauge is properly set. Refer to the Model 700 Troubleshooting Checklist (see Table 4-4) for values. Do not adjust; check with Measurement Services if your reading is abnormal.

Check the flow at the measure vent and sample vent (see Table 4-4).

4.6.6 Temperature

Use the Temperature Control function for monitoring the Temperature of the Oven (Detector/s and Columns) and the Stream Switching block to determine when the Model 700 is thermally stable. The bottom row labeled Temperature (C) displays the current temperatures.

The settings and values shown in Figure 4-10 and described in Table 4-5 are preset at the factory and are based on the specific customer application. These values should not be changed unless recommended by Application Engineering or Customer Service Personnel, or it is a factory application requirement.

When connected via MON2000, use the *Application>Temperature Control* menu path to access this function.

The Temperature Control dialog displays.

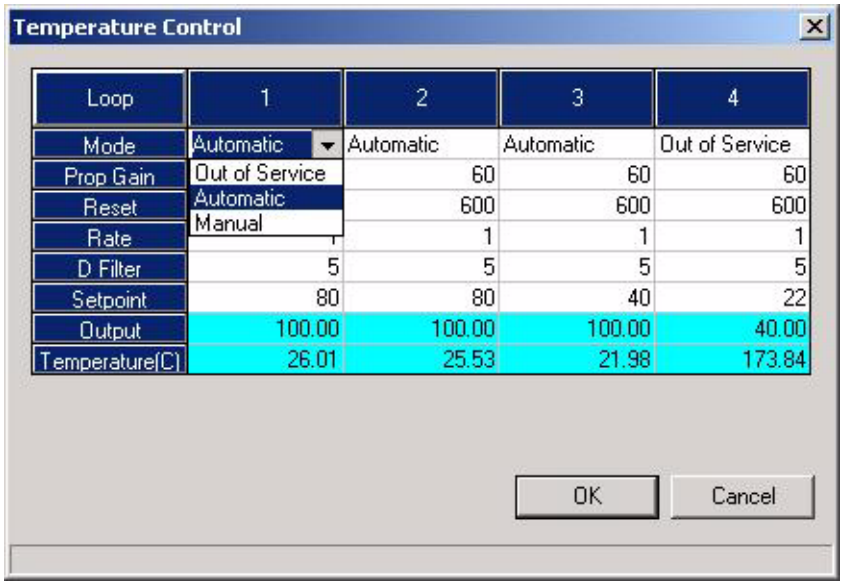


Figure 4-10 Temperature Control Dialog

Use the pull down menu to select the appropriate mode setting (e.g. AUTOMATIC, MANUAL, or OUT OF SERVICE). Ensure that the temperature is constant for the Oven (i.e. Multivalve System block and column module kit) and the SSS.

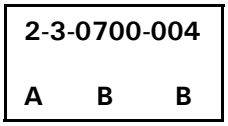
Columns 1 through 3 (Zones 1-3) have a temperature range of 20 °C to 100 °C (68 °F to 212 °F). Column 4 (Zone 4) has a temperature range of 20 °C to 450 °C (68 °F to 842 °F).

Table 4-5 Temperature Control Dialog

Column	Function	Typical Setting
Column 1	Detector/s or Block Temperature	80 °C (176.0 °F)
Column 2	Column Temperature	80 °C (176.0 °F)
Column 3	Sample Stream Block or Valco™ Valve	40 °C (104 °F) 60 °C (140 °F)
Column 4	Spare Or, Methanator Or, LSIV	N/A 300 °C (572 °F) 150 °C (302 °F)

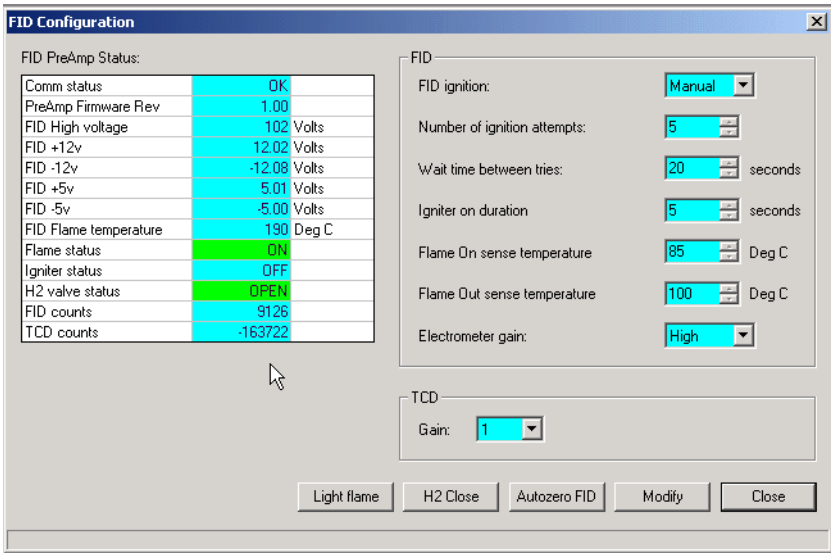
NOTICE

The Model 700 with a Micro-FID or LSIV has the Multifunction board (P/N 2-3-0700-004 Revision B with an extended temperature range for Column 4 (Zone 4) from 20 °C to 450 °C (68 °F to 842 °F). The board is labeled:



4.6.7 FID Configuration

When connected to the GC via MON2000, use the *Application>FID Configuration* menu to access the FID Configuration dialog. Refer to the *MON2000 Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for additional configuration details.



Configure the following fields from the FID Configuration dialog:

- FID Ignition - Manual or Automatic
- Number of Ignition attempts
- Wait time between attempts
- Igniter **ON** duration
- Flame **ON** sense temperature Degrees C
- Flame **OUT** sense temperature Degrees C
- Electrometer (TCD) gain

Baseline Drift

To ensure that the baseline is not drifting, compare the baseline upsets caused by valve actuations with those of the spectrum chromatogram provided with the Operational Parameters Sheet.

Ensure that no evidence of component elutions is present when sample is not being injected.

If differences exist between the two spectrum chromatograms, the problem may be due to one or more of the following:

- programming of events
- contamination of the multivalve sealing diaphragms by foreign matter
- improperly adjusted flows
- leaks in the carrier system
- column deterioration due to liquid contamination from a sample
- mis-identifying peaks

A noisy baseline can be caused by carrier leaks, an electronic failure in the preamplifier, a faulty power supply, or defective thermistors in the detector. If the baseline is still noisy after correcting for leaks, perform the Detector Bridge Balance procedure (see Section 4.9) before replacing the detector thermistors or the preamplifier board.

4.7 Leak Checks

4.7.1 Field Service

To perform a field-service leak check of the Model 700,

1. Plug all Model 700 vents.
2. Make sure the setting of the carrier cylinder regulator is 115 psig (pounds per square inch, gauge).
3. Check all fittings at the pressure regulator flow panel and at the carrier cylinder regulator with a leak detector. Correct any leaks detected by a bubble indication.
4. Turn the Carrier Gas shut-off valve clockwise to close. Observe the carrier pressure for ten minutes to check for a drop in carrier pressure.

   The drop should be less than 200 psig on the high side of the regulator/gauge. If the carrier pressure remains constant, no leaks are present.
5. Using MON2000, manually actuate the valves ON and OFF and observe the pressure with the valves in different positions (see Step 4).
6. If the pressure does not hold constant, check all valve fittings for tightness.
7. Repeat Step 5. If leaks persist, check the valve ports with a commercial gas leak detector.

NOTICE

When the valves are switched, some pressure change is normal because of carrier loss.

Momentarily open the cylinder valve to restore pressure if necessary (see Step 5).

NOTICE

Do not use a liquid leak detector on the valve or components within the MVS insulated cover.

4.7.2 Factory Level Leak Check

This section describes how to perform a factory-level leak check. Before performing the leak check, plug the Measure Vent (labeled “MV”) vent line if it is open. The Sample Vent (labeled “SV”) line should be left open, or unplugged.

The following steps are performed to leak-check the Model 700 at the factory when the unit is quality-checked prior to release. This procedure is more thorough and is designed to isolate specific zones where a leak may occur.

NOTICE

Do not use the "Carrier Pressure Adjust" valve (on the Flow Panel of the Model 700 GC) to adjust Carrier Gas line pressure. The valve is factory-set and should not be adjusted.

Leak check the Carrier Gas line first, according to the steps that follow.

1. Purge the valves with Carrier Gas:
   (a) Open the Carrier Gas bottle valve and slowly increase the Carrier Gas feed line pressure to 110 psig, ±2%, with a dual-stage regulator at the Carrier Gas bottle.
   (b) Using MON2000, manually actuate the valves ON and OFF about four to five times.
2. Pressurize and check the Carrier Gas feed line:
   (a) Set all Model 700 valves to ON.
   (b) Open the Carrier Gas bottle valve, and ensure that the Carrier Gas feed line pressure is 110 psig, ±2%.
   (c) Shut the Carrier Gas bottle valve.
   (d) Observe the pressure on the high-side regulator gauge of the Carrier Gas bottle. Because the MV vent line is plugged, the pressure should not decrease in 2 to 3 minutes.
   (e) Set all valves to OFF position.
   (f) Repeat Steps (b) through (d).
   (g) Via MON2000, set all valves to AUTO for regular operation.

NOTICE

Calibration gas line pressure of 50 psig is for leak check and test purposes only. For normal operation, the calibration gas line pressure is maintained at 20-30 psig.

Next, leak check the calibration gas feed line, per the following steps:

1. Plug the SV vent line.
2. Pressurize the calibration gas line to 50 psig.

(a) Shut the calibration gas bottle valve.

(b) Observe the pressure on the high-side regulator gauge of the calibration gas bottle. Because the SV vent line is plugged, the pressure should not decrease in a period of 2 to 3 minutes.

Next, leak check the sample gas lines, per the following steps:

1. Ensure that the Sample valve (SV) vent line is plugged.

   (a) Pressurize the sample gas line to 50 psig or a known pressure.

   (b) Shut off the sample gas.

   (c) Observe the pressure on any gauge that indicates pressure between the closed sample gas block valve and the plugged SV vent line. Because the line is plugged, the pressure should not decrease during a period of 2 to 3 minutes.

2. Leak test all other sample stream lines by connecting gas to each of the sample streams and repeating Step 1(a) through 1(b).

NOTICE

Calibration gas line pressure of 50 psig is for leak check and test purposes only. For normal operation, the calibration gas line pressure is maintained at 20-30 psig.

Finish the test and set up the Model 700 for normal operation, as follows:

1. Using MON2000, ensure that all valves are set to AUTO.
2. Unplug, or open, the MV and SV vent lines.
3. If the calibration gas bottle was used to leak check the sample stream lines, reconnect the calibration gas bottle to the calibration gas line on the flow panel assembly. Reconnect the sample stream lines.

4.7.3 Plugged Lines, Columns, or Valves

To ensure that lines, columns, and valves are not plugged, check the gas flow at valve ports. For a reference, use the flow diagram in the drawing package, and remember these points about flow diagrams:

- Port-to-port flow paths are indicated by solid or dashed lines.
- A dashed line indicates flow direction when the valve is ON, that is, energized.
- A solid line indicates flow direction when the valve is OFF, i.e., not energized.
- A combination of solid and dashed lines indicates a constant flow path regardless of the ON/OFF state of the valve.

4.8 CHROMATOGRAPH VALVES

Only minimal repair and maintenance is required by the customer (e.g., replacing the diaphragms). Measurement Services recommends returning the Oven Assembly for major repairs to maintain the validity of the warranty.

4.8.1 Required Tools

The tools required for performing repair and general maintenance on the valve assemblies are:

- torque wrench, scaled in foot-pounds
- 1/2” socket
- 1/4” open-end wrench
- #1 flat screwdriver

4.8.2 Chromatograph Valve Replacement Parts

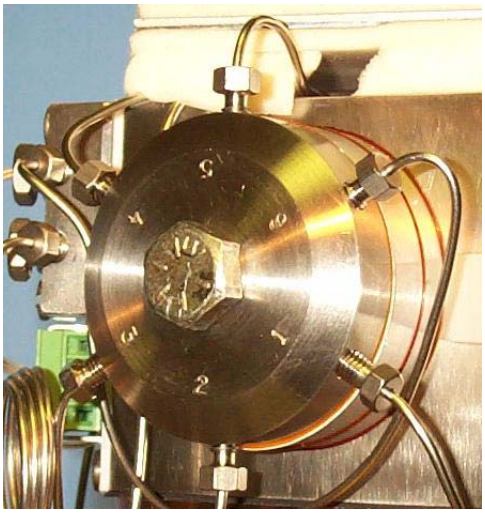
Replacement parts required for each of the chromatograph valves on the Oven Assembly consists of the following parts:

- Diaphragm Kit 6-port Valve (P/N 2-4-0700-187)
- Diaphragm Kit 10-port Valve (P/N 2-4-0700-171)

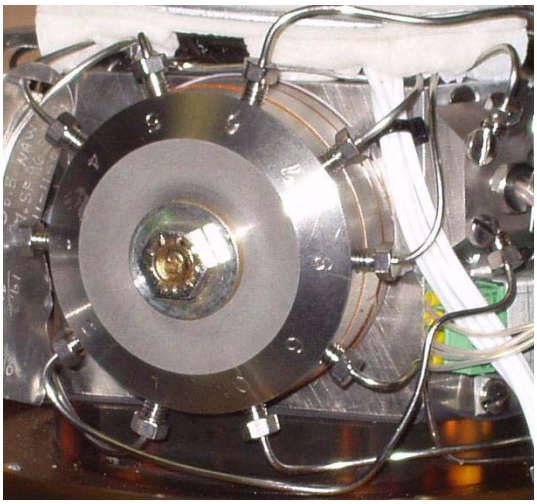
NOTICE

If an existing unit has a teflon gasket between the lower actuation diaphragms and the kiosk block, install gasket P/N 2-4-0700-064 (for 6-port valves) and P/N 2-4-0700-160 (for 10-port valves). Otherwise, the teflon gasket is not required.

Model 700 TCD Upper Enclosure



6-port Valve



10-port Valve

Figure 4-11 Chromatograph Valve Assemblies

4.8.3 Valve Cleaning

For cleaning the valve, isopropyl alcohol (P/N 9-9960-111) should be used.

NOTICE

Do not use an oil base cleaner on the valve.

NOTICE

The Oven System may be removed and repaired at a bench. However, it is not necessary to remove the oven.

4.8.4 TCD Oven System Removal

Use the following procedure for removing the Oven System from the Model 700 unit:

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Disconnect all electrical power to the unit and ensure the area is free of explosive gases.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

1. Disconnect all power to the unit.
2. Remove the explosion proof dome and the thermal cover.

Model 700 Upper Enclosure

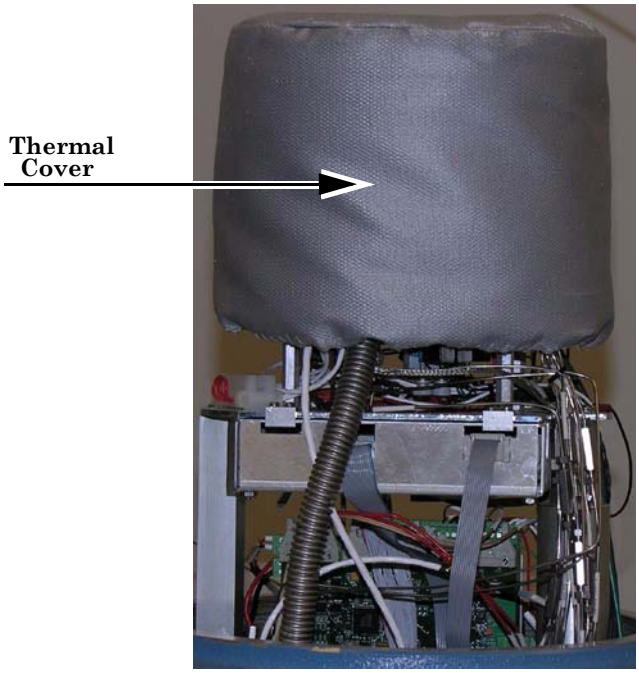


Figure 4-12 Micro-FID Oven System Thermal Cover

3. Loosen the screw on the mounting bracket that secures the Oven Plate to the support post (see Figure 4-13).
4. Lift up slightly and rotate the oven forward one quarter turn so that the components are accessible.

Model 700 TCD Upper Enclosure

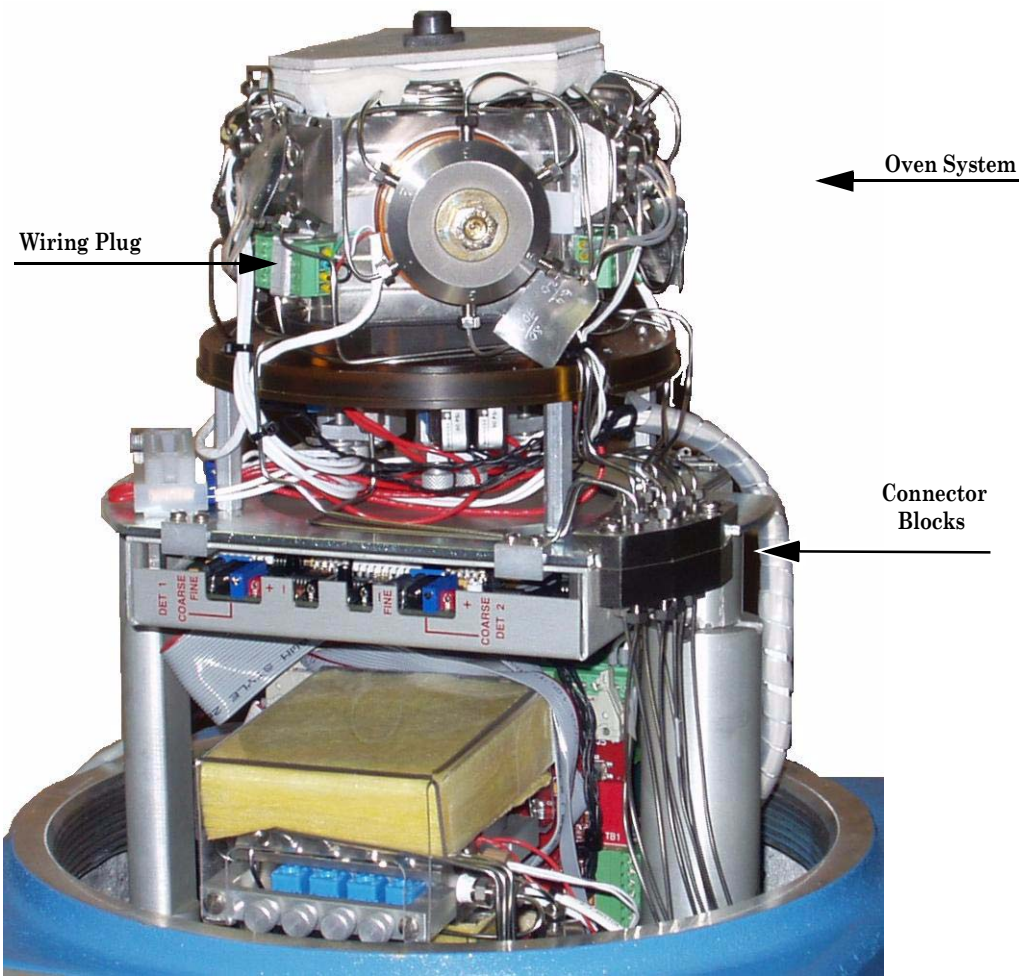


Figure 4-13 TCD Upper Assembly Components

5. Unplug the solenoid wiring from the driver board end.
6. Unplug the heat control wiring from the driver board side.

7. Unplug the heater wiring from the driver board end.
8. Loosen the screws on the connector blocks.

Model 700 TCD Upper Enclosure

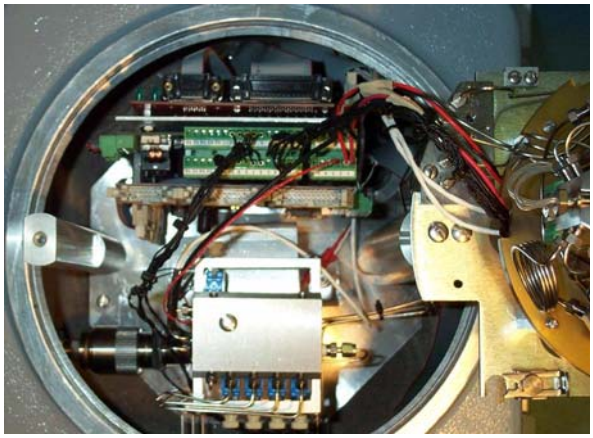


Figure 4-14 TCD Oven System Disassembly

9. Disconnect the three Preamplifier wires and the solenoid wire plug (see Figure 4-14).
10. Lift the oven assembly from the unit for bench maintenance and repairs.
11. Reinstall in reverse order of Steps 1-9.

4.8.5 Micro-FID Removal

Use the following procedure for removing the Micro-FID from the Model 700 unit.

WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Disconnect all electrical power to the unit and ensure the area is free of explosive gases.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

1. Disconnect all power to the unit.
2. After powering down the Model 700, allow at least 10 minutes for the components to cool-down.
3. Remove the explosion proof dome and the thermal cover.

CAUTION

MAY CAUSE INJURY TO PERSONNEL

This unit operates at high temperature. Allow a cool-down period of at least 10 minutes after shut-down and handle the unit carefully.

Failure to follow this precaution may result in injury to personnel

Model 700 Micro-FID Upper Enclosure

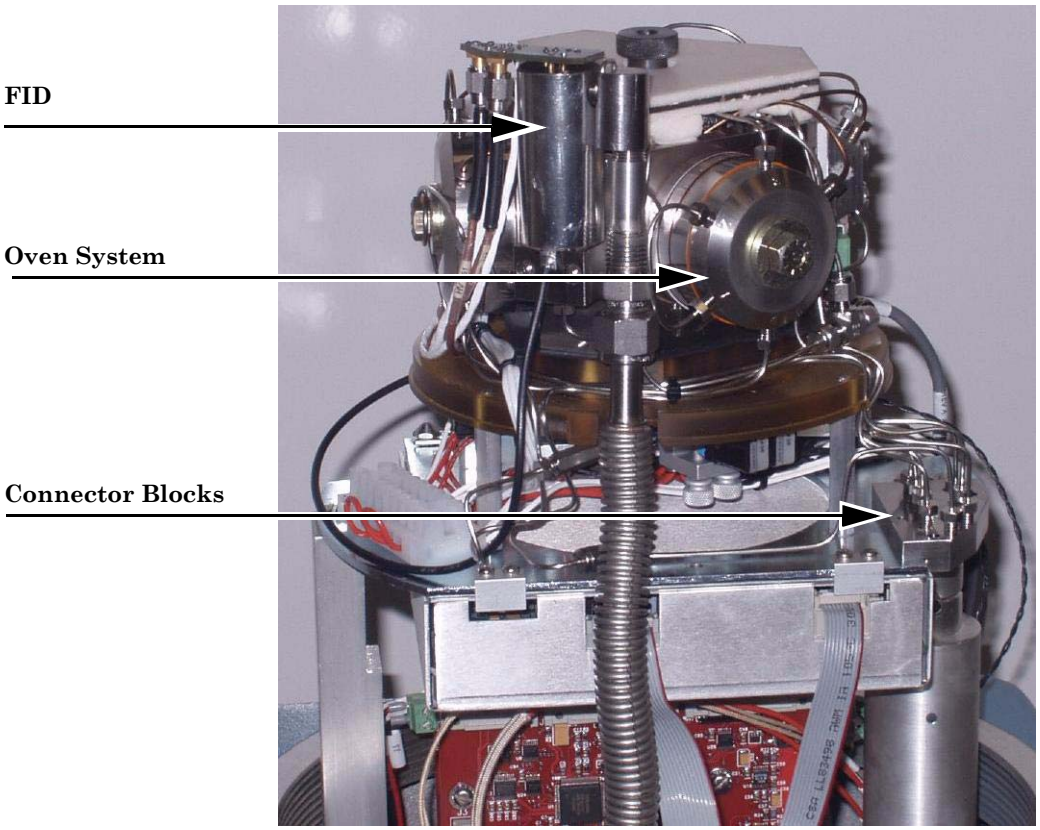


Figure 4-15 Micro-FID Upper Assembly Components

4. Grasp the edges of the Connector Board on top of the unit and pull and wiggle to remove the six socket tubes that extend onto the pins in the cap (see Figure 4-16).

5. Remove the exhaust tube from the side by pulling the 'U' shaped retainer from the top of the exhaust body and moving the exhaust tube away from the Micro-FID. Take care not to lose the clip.

Model 700 Micro-FID Upper Enclosure

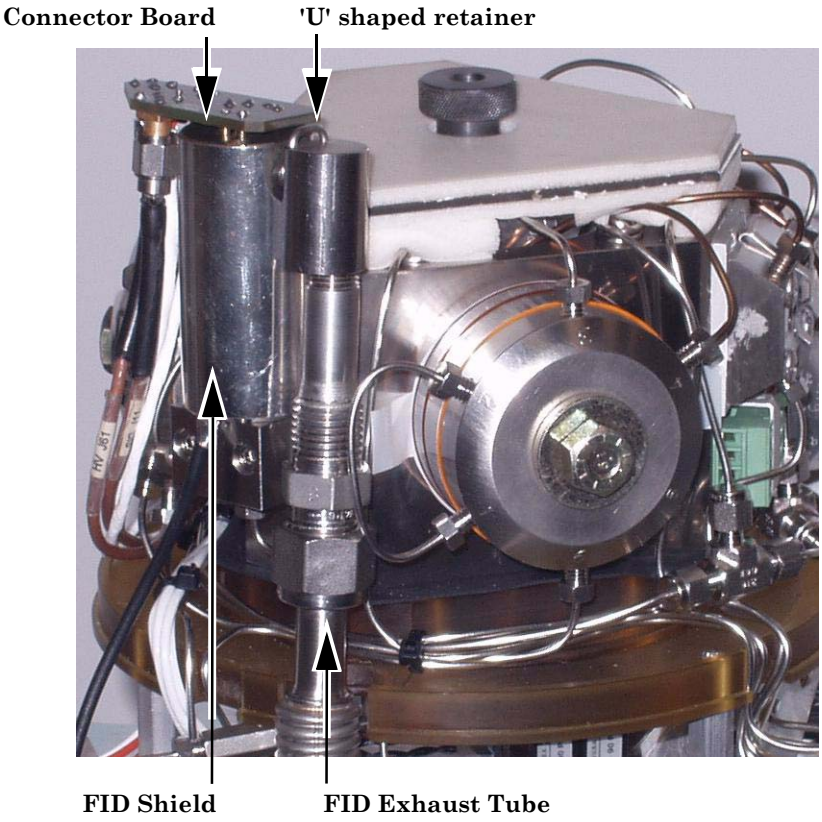


Figure 4-16 Model 700 with Micro-FID Upper Assembly

6. Loosen the two screws in the top of the Micro-FID.
7. Grasp the shielded section and lift it over the burner. Pull the cap out of the shield. Remove the body from the shield, if necessary.

4.8.6 Micro-FID Maintenance

The Micro-FID cap has no replaceable parts. Damage like a broken RTD or broken igniter coil requires a replacement cap.

The burner tip can be removed for cleaning.

1. Loosen the isolating nut one turn.
2. Gently lift out the burner tip tube. Use short needle nose pliers if it is stubborn, taking care not to bend the tube. The alternative is to unscrew the assembly and clean as an assembly.

4.8.7 Micro-FID Re-assembly

1. Insert burner tip tube into the isolating nut. Be certain it is fully seated. There should be about .350" of tube visible.
2. Tighten the isolating nut in small increments until the tube ceases to pull free. Slight additional tightening will ensure proper sealing.
3. Place the cap onto the end of the body with the deep cavity. Once the alignment pin is in its mating hole, gently press the two parts together and ensure the o-ring is seated properly.
4. Slide the Micro-FID shield onto the body from the bottom. Align the notch with the exhaust fitting and insert the two screws.
5. Lower the Micro-FID body assembly onto the base, placing the alignment pin in its hole. Press the body into place, seating the o-ring. Tighten the screws slightly more than 'finger tight.'
6. Re-connect the ground lead.

7. Press the Micro-FID exhaust tube onto the fitting and anchor with the 'U' shaped clip. (1/16" tubing makes an adequate clip.)
8. Plug the connector board onto the cap.
9. Replace the thermal cover on the upper enclosure.

Model 700 FID/TCD Upper Enclosure

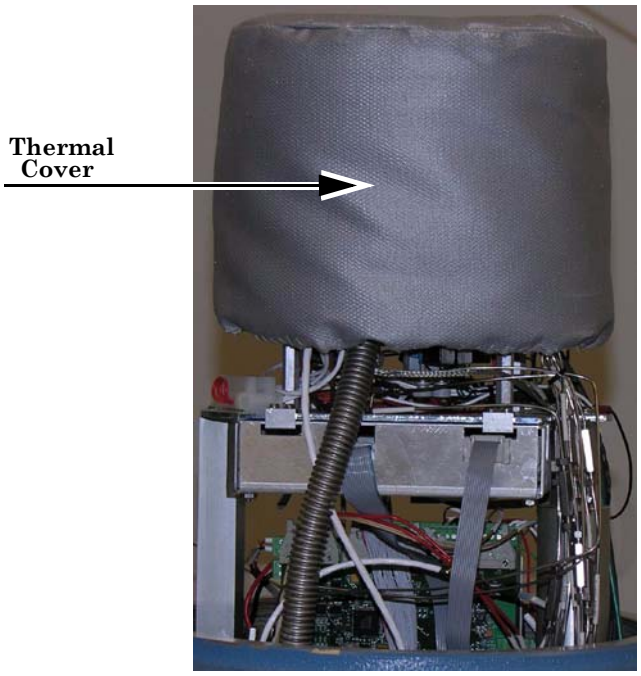


Figure 4-17 Upper Enclosure Thermal Cover

10. Replace the explosion-proof cover on the assembly, then apply power to the unit.

4.8.8 LSIV Maintenance

The LSIV can be maintained while attached to the enclosure. However, the user may find it easier to perform maintenance with the LSIV removed from the Model 700 upper enclosure.

CAUTION

MAY CAUSE INJURY TO PERSONNEL

This unit operates at high temperature. Allow a cool-down period of at least 10 minutes after shut-down and handle the unit carefully.

Failure to follow this precaution may result in injury or death to personnel

4.8.9 LSIV Removal

Inside the Model 700 upper enclosure there are two insulation covers (which open like clam shells that slide off of the end of the LSIV) to be removed.

1. Disconnect the carrier and sample tubing from the LSIV.
2. Remove the heater and RTD from the heater block.
3. Disconnect sample and air tubing from the outer portions of the LSIV.
4. Unscrew the retaining ring, using a pin spanner wrench or other tool. With the retaining ring loose, the LSIV assembly is free to be pulled out of the upper enclosure.

Replacing LSIV Seals

CAUTION

DAMAGE TO EQUIPMENT

Use of wrenches other than a strap wrench to disassemble the LSIV can damage the valve beyond repair.

Failure to follow this precaution may damage equipment.

Tools Required for Disassembly:

- 2 each - 1 inch strap wrenches
- 1 each - assembly tool for seal nuts

1. Using two strap wrenches, if needed, unscrew the seal assist housing from the LSIV body. Once the threads are free, pull the pieces apart taking care to avoid bending the stem.
2. There are two seals with a central packing gland between them to be removed, either from the stem or the bore in the body. Use care to avoid scratching the stem or bore surfaces.
3. Replace the two seals with the central packing gland between them onto the stem. Carefully align the two assemblies and insert the seals into the bore.
4. Screw the assemblies together hand-tight.

LSIV Disassembly

Use the following procedure to disassemble the LSIV and refer to Figure 4-18.

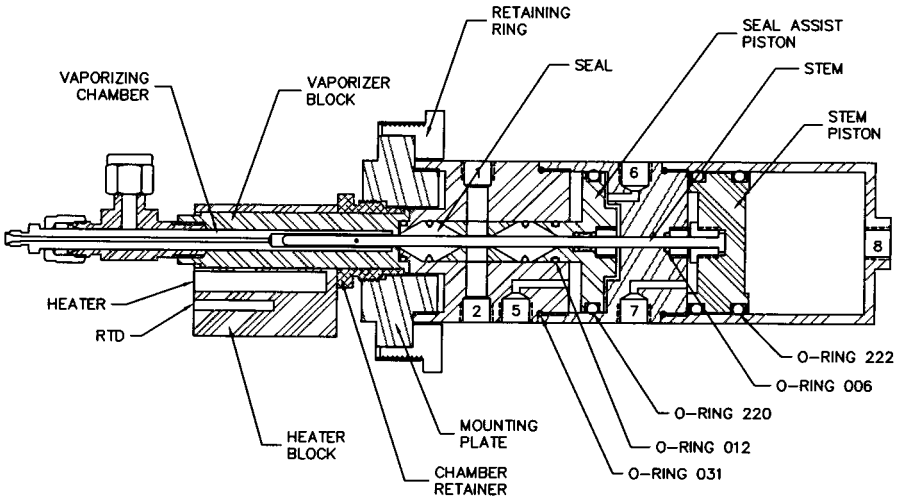


Figure 4-18 Model 700 with LSIV

1. Use the one (1) inch strap wrenches and unscrew the piston housing (counter-clockwise) from the seal assist housing (use one strap wrench on the piston housing and one strap wrench on the seal assist housing).

CAUTION

DAMAGE TO EQUIPMENT

Use care when disassembling the LSIV to prevent bending the valve stem.

Failure to follow this precaution may cause damage to the equipment.

2. When the threads disengage, slowly continue to pull apart the LSIV assembly. Be careful not to bend the valve stem and pull until the valve stem is free of the seal assist housing or the piston is free of the piston housing.
3. Separate the piston and valve stem assembly from the piston housing or seal assist housing by carefully pulling it straight out.
4. Unscrew (counter-clockwise) the seal assist housing from the lower body.
5. Unscrew (counter-clockwise) the retaining ring from the body.
6. Pull the piston/packing gland out of the lower body.
7. Push out the football seals and the central packing gland from the body.
8. Unscrew (counter-clockwise) the stem lock nut from the piston.
9. Remove the valve stem from the piston.
10. Unscrew the seal nut from the upper piston packing gland.
11. Remove the o-rings and the collar.

4.8.10 Methanator Maintenance

The optional Methanator, a catalytic converter, converts otherwise undetectable CO_2 and/or CO into methane by adding hydrogen and heat to the sample. The Methanator requires little maintenance.

Model 700 Methanator Upper Enclosure

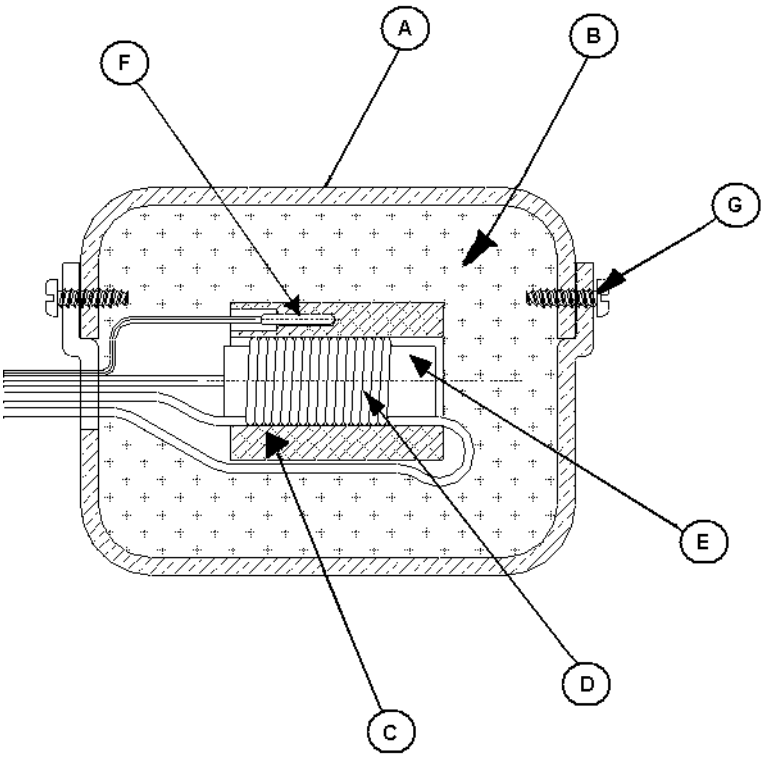


Figure 4-19 Model 700 Optional Methanator Assembly

The assembly consists of:

- A: Case
- B: Insulation
- C: Tube
- D: Catalytic Column
- E: Heater
- F: RTD (temperature detector)
- G: Two #6-20 x 1/2 stainless steel screws

The RTD can be replaced , if necessary. If it is replaced, care must be taken to anchor the RTD cable to the tubing to prevent loosening over time.

A catalytic column needing replacement should be replaced with a full heater/column assembly that includes the tube, column, heater and RTD.

To replace the catalytic column (see Figure 4-19),

1. Disconnect the tubing and wiring, then lift the Methanator from the enclosure.
2. Remove the two screws and open the box (enclosure). The catalytic column assembly is housed inside this insulation-filled box.
3. Exchange the catalytic assembly and re-fill the enclosure with insulation.
4. Reverse this procedure to reassemble the Methanator.

4.8.11 Valve Overhaul

The chromatograph valves are designed to withstand millions of actuation cycles without leakage or failure. If service is required, the valve can be overhauled using replacement parts available from Measurement Services.

NOTICE

Replacement factory-built valves are available.

We recommend returning and replacing the 6-port Valve for extensive repairs or complete replacement.

Use the following procedure for overhauling a 6-Port Valve:

NOTICE

The Oven System may be removed and repaired at a bench. However, it is not necessary to remove the oven.

1. Shut off carrier and sample gas streams entering the unit.
2. Remove the insulating cover from the Oven System.
3. If the faulty valve is not easily accessible, loosen the thumb screw and rotate the oven forward (see Figure 4-13 and Figure 4-14).
4. Disconnect tubing and fittings that attach to the valve from other locations.

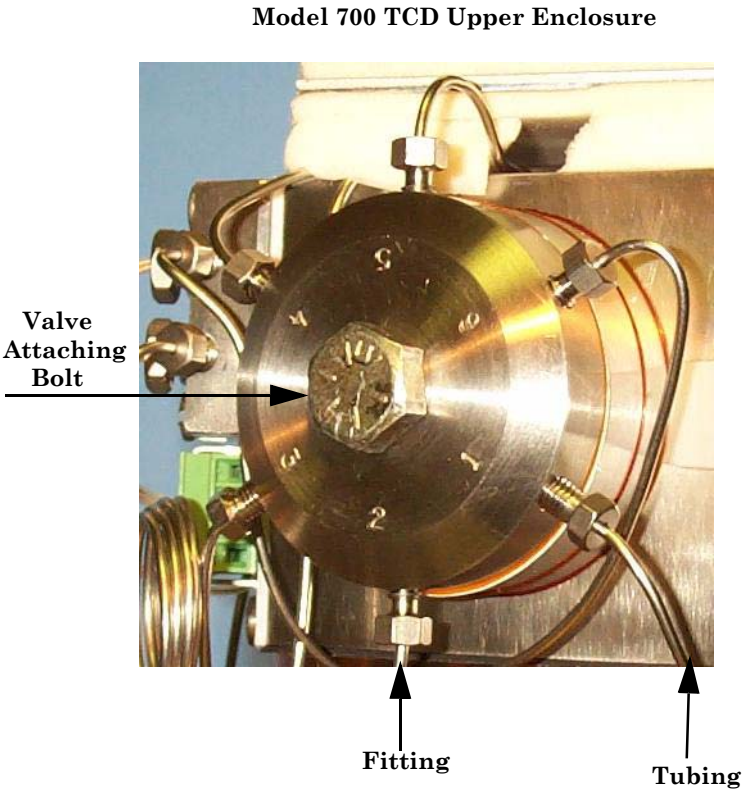


Figure 4-20 TCD Valve Tubing and Fittings

5. Loosen the attaching bolt on the valve to be replaced or serviced (see Figure 4-20).

6. Holding the lower piston plate, pull the valve straight off the block. The alignment pins may stick slightly.
7. Remove and discard the old valve diaphragms and gaskets. Replace, in the same order, with the new ones supplied.
8. Reinstall the valve using the following steps:
   (a) Clean the sealing surface as required using Chemwipes with alcohol. Blow the sealing surface with clean, dry instrument air or Carrier Gas. Dirt including dust and lint can cause troublesome leakage.
   (b) Align the pins with holes in the block and push the valve assembly into place.
   (c) Tighten the valve "attaching bolt" to 30 lbs./ft. (40 N-m)
   (d) Reconnect all fittings and tubing (see Figure 4-20).

NOTICE

Ensure that the primary seal diaphragm is correctly installed on the primary plate.

NOTICE

Do not scratch the primary plate surface.

NOTICE

Do not use an oil base cleaner on the valve.

4.8.12 Oven System and Stream Switching System Solenoid Valve Replacement

Both the Oven System and the Stream Switching System use the same solenoid valves. The solenoids are replaced in both systems using the same procedure (see Section 4.8.13).

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Disconnect all electrical power to the unit and ensure the area is free of explosive gases.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

4.8.13 Solenoid Valve Replacement

Replace the Oven System and Stream Switching System (SSS) solenoids using the following steps.

NOTICE

Carrier Gas leaks may be caused by the SSS solenoids See Section 4.7 for leak check procedures.

1. Remove the dome from the upper enclosure.
2. Loosen the mounting bracket thumb screw that secures the oven to the chassis, see Figure 4-21.

Model 700 TCD Upper Enclosure

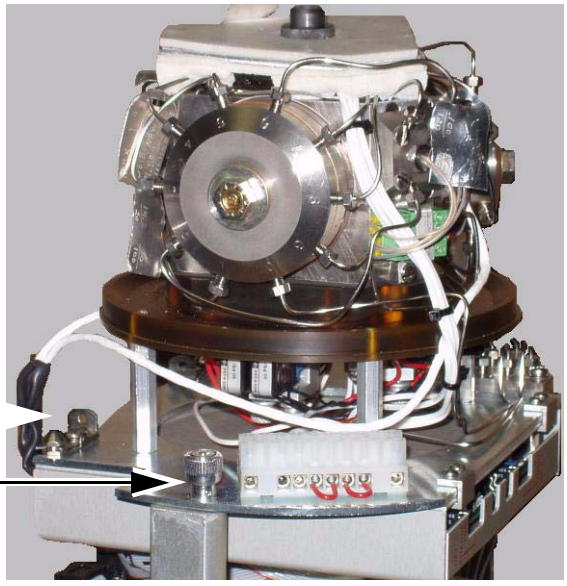


Figure 4-21 Side View TCD Oven System Mounting Bracket

3. Holding the left side of the oven mounting plate, gently lift up the assembly and rotate it so that the enclosure opening is accessible.

Model 700 TCD Upper Enclosure

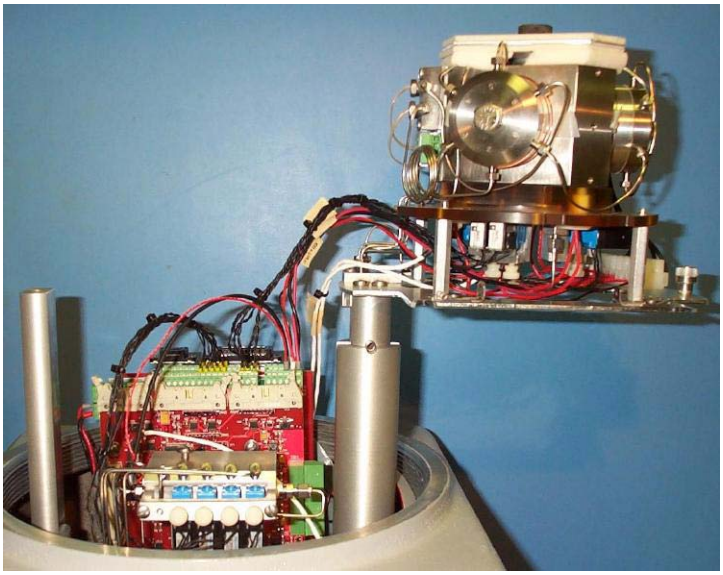


Figure 4-22 Rotated TCD Upper Assembly

4. Loosen the thumb screws holding the valve in place.

Model 700 TCD Upper Enclosure

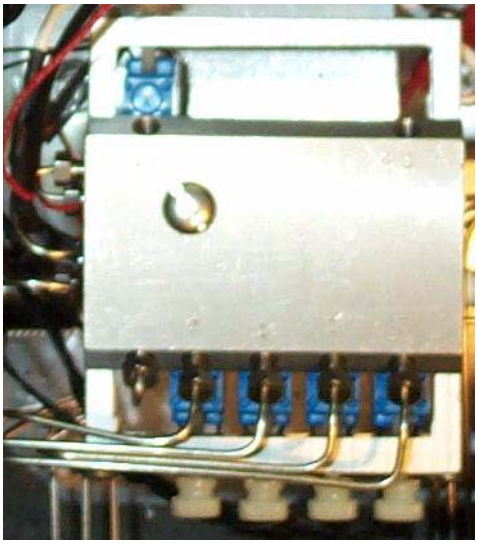


Figure 4-23 Stream Switching Assembly

5. Lift the solenoid off of the alignment pins (approximately 1/8”).
6. Slide out the solenoid block.
7. Disconnect the wire leads and remove the gasket from the bottom of the solenoid block.
8. Replace the old leads at the connector plug or splice the wires from the new solenoid to the old leads.

NOTICE

The solenoids are not polarity sensitive.

9. Reassemble the SSS and Oven System in reverse order of Steps 1 through 7.

Model 700 TCD Upper Enclosure

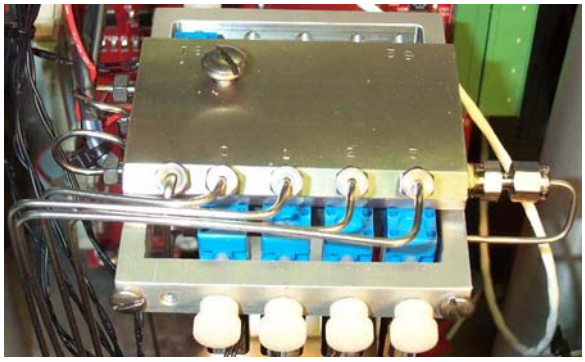


Figure 4-24 Stream Switching System Final Assembly

4.9 TCD DETECTOR BRIDGE BALANCE

The following procedure should be performed if the Model 700 does not produce a chromatogram.

If necessary to balance the detector bridge,

1. Remove the cover of the upper explosion-proof housing and the thermal cover on the Model 700 for access the preamplifier.

Model 700 FID/TCD Upper Enclosure

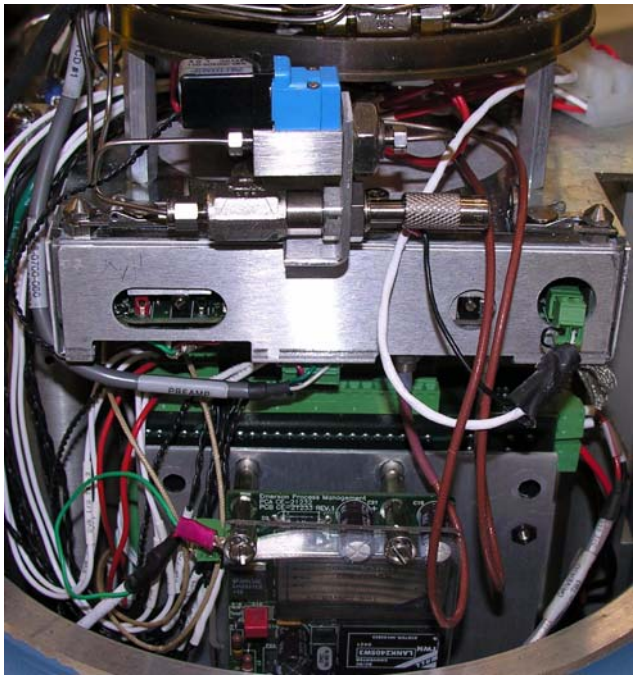


Figure 4-25 Model 700 Micro-FID/TCD Preamplifier

2. Attach the negative lead of a digital voltmeter to the black test point (-BRIDGE BALANCE). Attach the positive lead of the digital voltmeter to the red test point (+BRIDGE BALANCE).

Model 700 TCD Upper Enclosure

Figure 4-26 Model 700 TCD Bridge Balance

Model 700 Micro-FID Upper Enclosure

Figure 4-27 Model 700 Micro-FID Bridge Balance

3. Check the detector bridge voltage. The voltage should read 0 millivolts (mV), ±0.5 mV. Adjust the coarse and fine potentiometers which are located immediately to the left of each of the (red) test points to obtain the specified reading.

4.10 MEASURE VENT FLOW

You will need an accurate flow meter for this measurement.

To measure the MV vent flow, proceed as follows:

1. Attach a flow meter to the vent output on the right side of the Model 700 "MV1"(marked on the tag).

   The flow should measure 12-18 cc/min.

2. Attach a flow meter to the vent "MV2" marked on the tag.

   The flow should measure 12-18 cc/min.

Model 700 Upper Enclosure

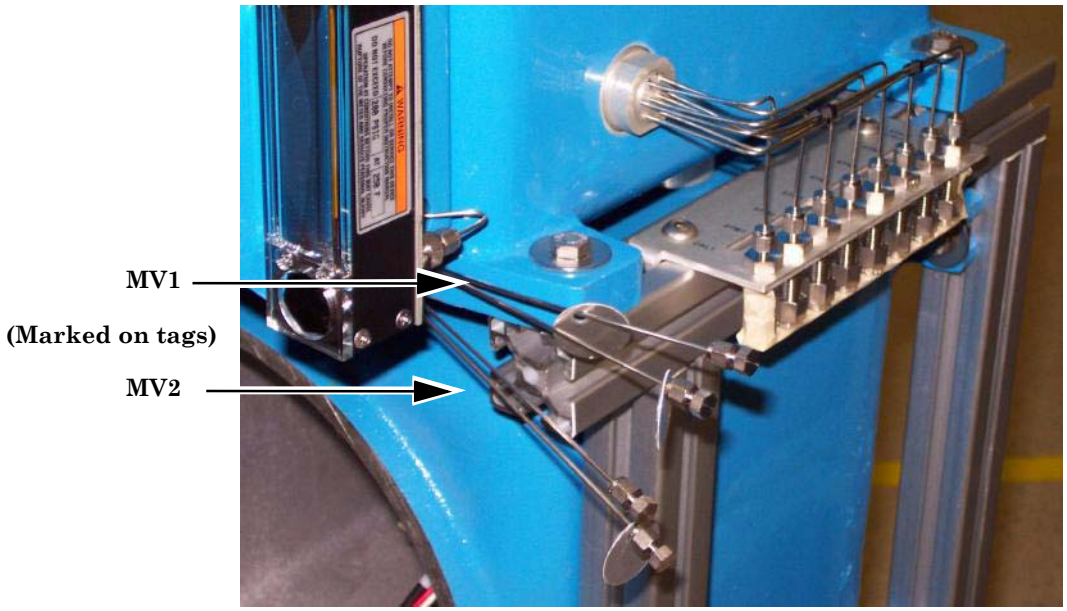


Figure 4-28 Measure Flow Vents

4.11 MODEL 700 ELECTRICAL COMPONENTS

The Model 700 GC is designed to operate for long periods of time without need for preventive or regularly scheduled maintenance. The Model 700 is designed using explosion-proof enclosures. The enclosure is dust-proof, water-proof, and flame-proof.

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Disconnect all electrical power to the unit and ensure the area is free of explosive gases.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

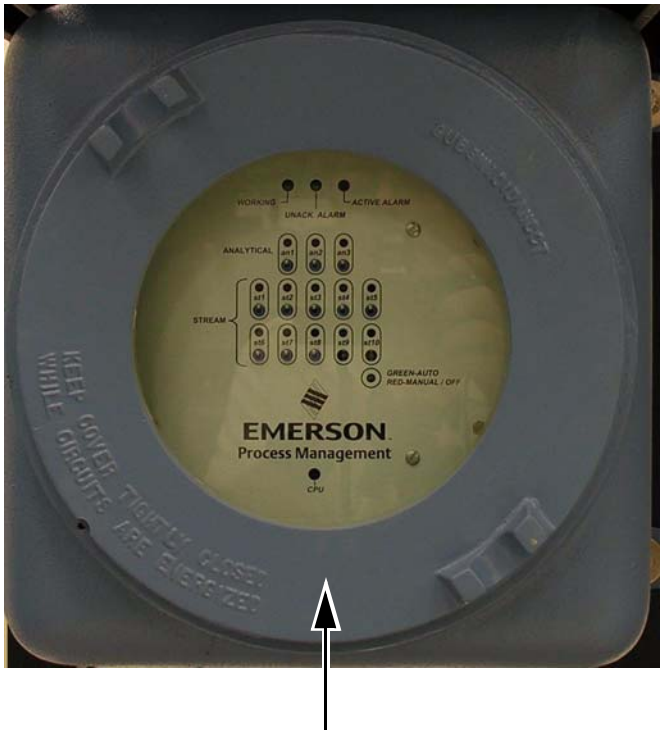
Should there be a need to open the explosion-proof enclosure, first disconnect all electrical power to the unit, and ensure the area is free of explosive gases. Prior to opening the Model 700, check the operating parameters of the application with a PC using MON2000 software and attempt to isolate or fix any incorrect parameters.

To access the GC electrical components,

1. Ensure electrical power is disconnected from the unit and the environment is safe.

2. Remove the lower enclosure cover and access the card cage assembly holding the circuit boards.

Model 700 Lower Enclosure



Explosion-proof Cover

Figure 4-29 Model 700 Lower Enclosure

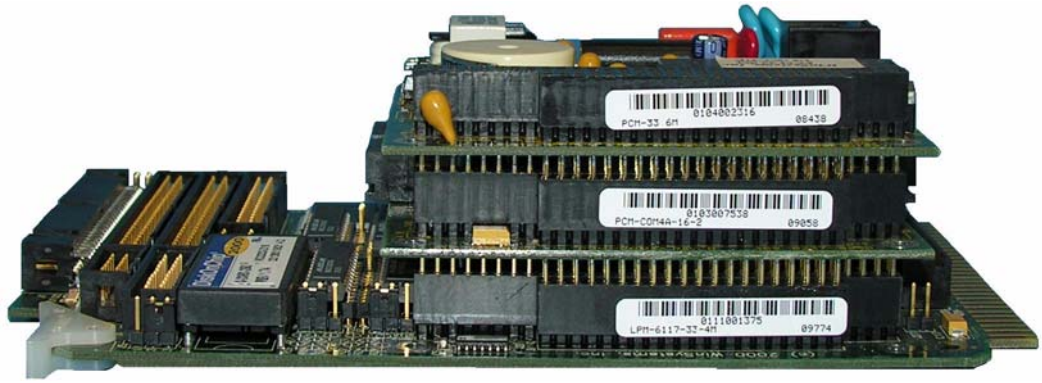


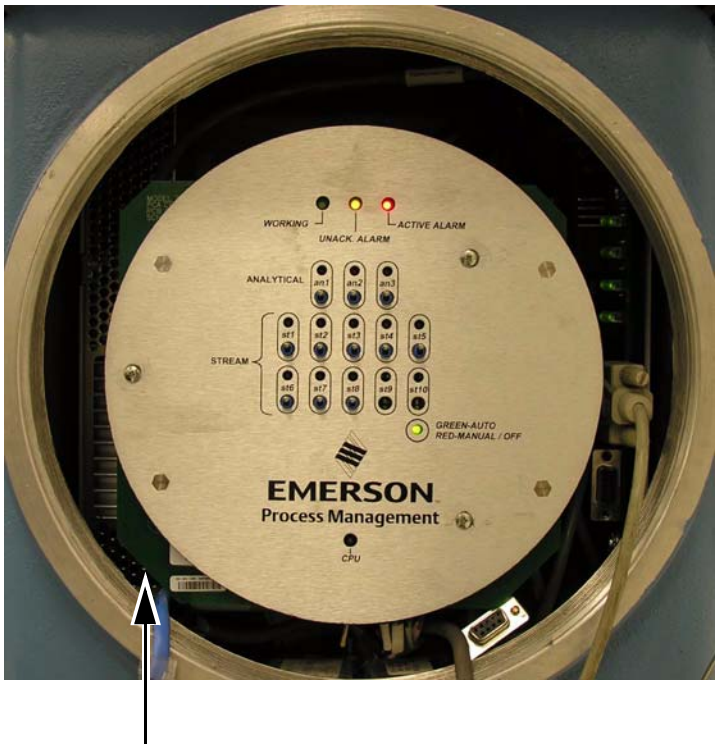
Figure 4-30 Model 700 Card Stack Assembly

3. Note the location and direction of any board removed. Remove only one end of any cable necessary to obtain access to the desired board. Remember or make note of the cable installation so that the cables can be replaced in the same order. Release the catch(es) and remove/replace the circuit board(s) as necessary.

NOTICE

After removing the cable(s), any board may be replaced without removing the card cage assembly.

Model 700 Lower Enclosure



Card Cage Assembly

Figure 4-31 Model 700 Lower Assembly

4.11.1 DC Power Supply Replacement Procedures

The DC/DC Power Supply is mounted on the left wall of the lower enclosure (see Figure 4-32) and is accessible by removing the threaded cover plate from the housing.

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Disconnect all electrical power to the unit and ensure the area is free of explosive gases.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

Model 700 Lower Enclosure

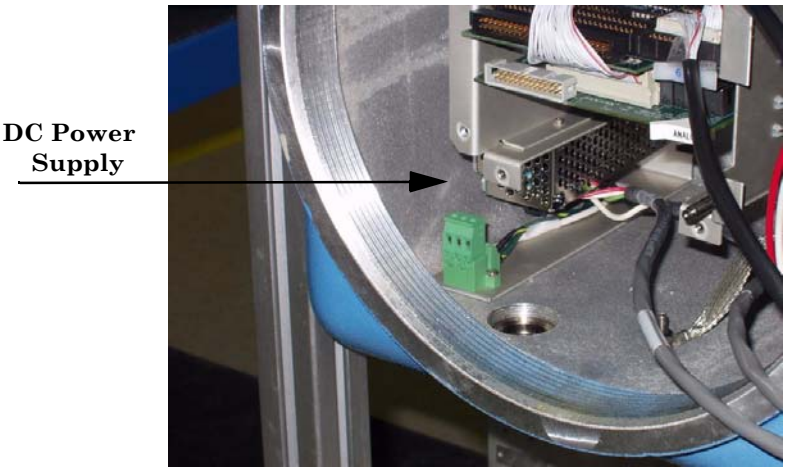


Figure 4-32 DC Power Supply Lower Enclosure

Tools required to remove and replace the DC Power Supply:

- Cross point #2 Phillips screw driver (long shank is helpful).
- Head lamp (flashlight)

NOTICE

Needle nose pliers may be used to turn rear thumbscrews.

To remove and replace a faulty DC Power supply:

1. Disconnect the cables from the CPU, the Com4A board (if installed), the modem board and the Ethernet board (if installed).
2. Unscrew the card cage thumb screws and remove the card cage assembly.
3. Unscrew the two thumb screws on the power supply bracket.
4. Remove the assembly from the unit.
5. Disconnect, label and bundle all leads.
6. Attach all leads to the new DC Power Supply.
7. Align the power supply bracket and tighten the two thumb screws.
8. Reinstall the card cage assembly, tighten the thumb screws and reconnect all cables.
9. Replace the threaded cover plate on the lower enclosure housing.

NOTICE

See Appendix A for a list of the ports and terminals (pins) assigned to serial communications.

4.12 COMMUNICATIONS

Model 700 GC with the TCD

The Model 700 GC with the TCD has seven communications channels available; without the LOI installed, three communications ports from the WinSystems CPU board (P/N CE-20765) and four communications ports from the Com4A board. Six communication channels are available; with the LOI installed, two from the WinSystems CPU board and four ports from the Com4A board.

Model 700 GC with the Micro-FID/TCD

The Model 700 GC with the TCD has two communications channels available; without the Com4A board installed. Model 700, with the Com 4A board installed, has six communications ports available on the FTB; Com1 and Com2, and Com5, Com6, Com7, and Com8.

Com 4 is dedicated to the Micro-FID/TCD Preamplifier. When the LOI becomes available, it will use a video board instead of a serial port connection (see Figure 3-20 and Figure 3-21).

The communication protocols are selected inside the Model 700 GC with jumpers. The protocols are normally specified by the customer and then set at the factory.

If it becomes necessary to change the communications settings at the site, access to the boards inside the enclosure is required to make changes. See Section 3.4.2 if a communications change becomes necessary.

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

The enclosure should not be opened when hazardous gases are present.

Failure to do so may result in injury or death to personnel or cause damage to the equipment.

The jumpers to be changed are located on the WinSystems CPU board and the WinSystems Com4A board.

When the desired Model 700 GC address (Com ID) is known, it will be set before the unit leaves the factory. If the address (Com ID) needs to be changed in the field, it will be necessary to change the arrangement of an 8-position DIP switch on the multifunction board.

Model 700 Upper Enclosure

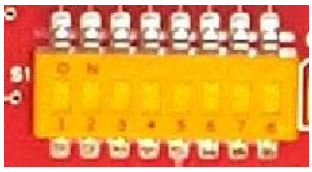


Figure 4-33 Dip Switch

This board is mounted on a bracket towards the center of the upper enclosure.

Model 700 TCD Upper Enclosure

Multifunction Board

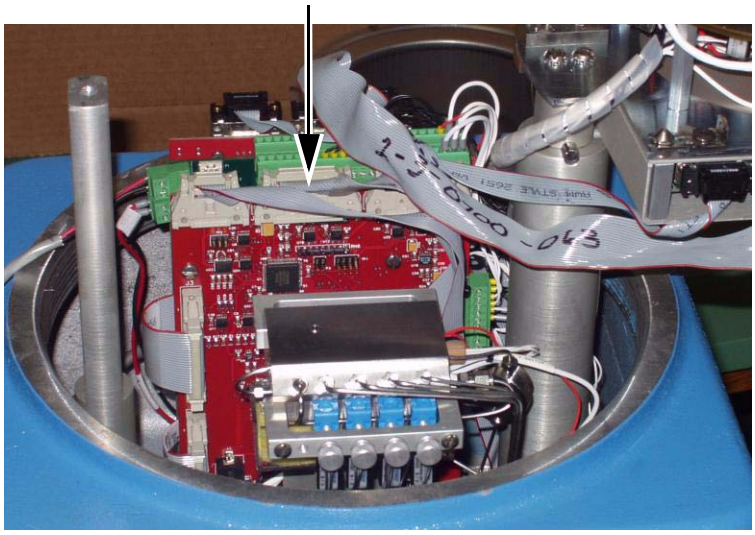


Figure 4-34 Multifunction Board

Ensure the cables are replaced in the exact order and positions.

NOTICE

See Section 3.4.1 this manual, for an explanation of DIP switch settings and their determination of the GC Controller Modbus slave address (Com ID).

(a) For example Model 700 GCs with a TCD,

- Switches "1" through "5" form a 5-bit binary number for setting the Modbus slave address (also known as Com ID or Device ID.)
- Switch number “1” is the least significant bit, and switch number “5” is the most significant bit. Set these switches either ON or OFF.

- Switch "6" is a spare for future use. Switches "7" and "8" are set as needed for the presence of an optional LOI (Local Operator Interface) connected via COM8 (when the COM4A board is installed).
  If the COM4A board is not installed, the LOI is connected via COM4. This address should display via the MON2000 software.

(b) For example Model 700 GCs with a Micro-FID ,

- Switch number “1” is the least significant bit, and switch number “5” is the most significant bit. Set these switches either ON or OFF.
- Switch “6” and “7” are spares and switch “8” is used to cold start the processor (see Table 3-5).

4.13 ANALOG INPUTS/OUTPUTS

The analog outputs can be calibrated and or adjusted via the MON2000 software. However, these outputs should be measured with a good digital meter upon initial installation at zero scale and full scale. Then the span can be set with MON2000 software so that it represents values from zero to 100 percent of the user-defined units in use.

Nominally, calibration is made within a range of 4-20 milliamperes (mA) output from each analog channel. However, zero scale calibrations can be set with 0 mA output, and full scale calibration can be set with up to 22.5 mA output. If there is reason to suspect that the span on any particular channel might be off after a period of time and heavy use, then the analog output for that channel should be recalibrated.

4.13.1 Model 700 Analog Inputs

There are four analog inputs available on the Field Termination Board (J4 - 12-pin Phoenix connector).

Model 700 Upper Enclosure

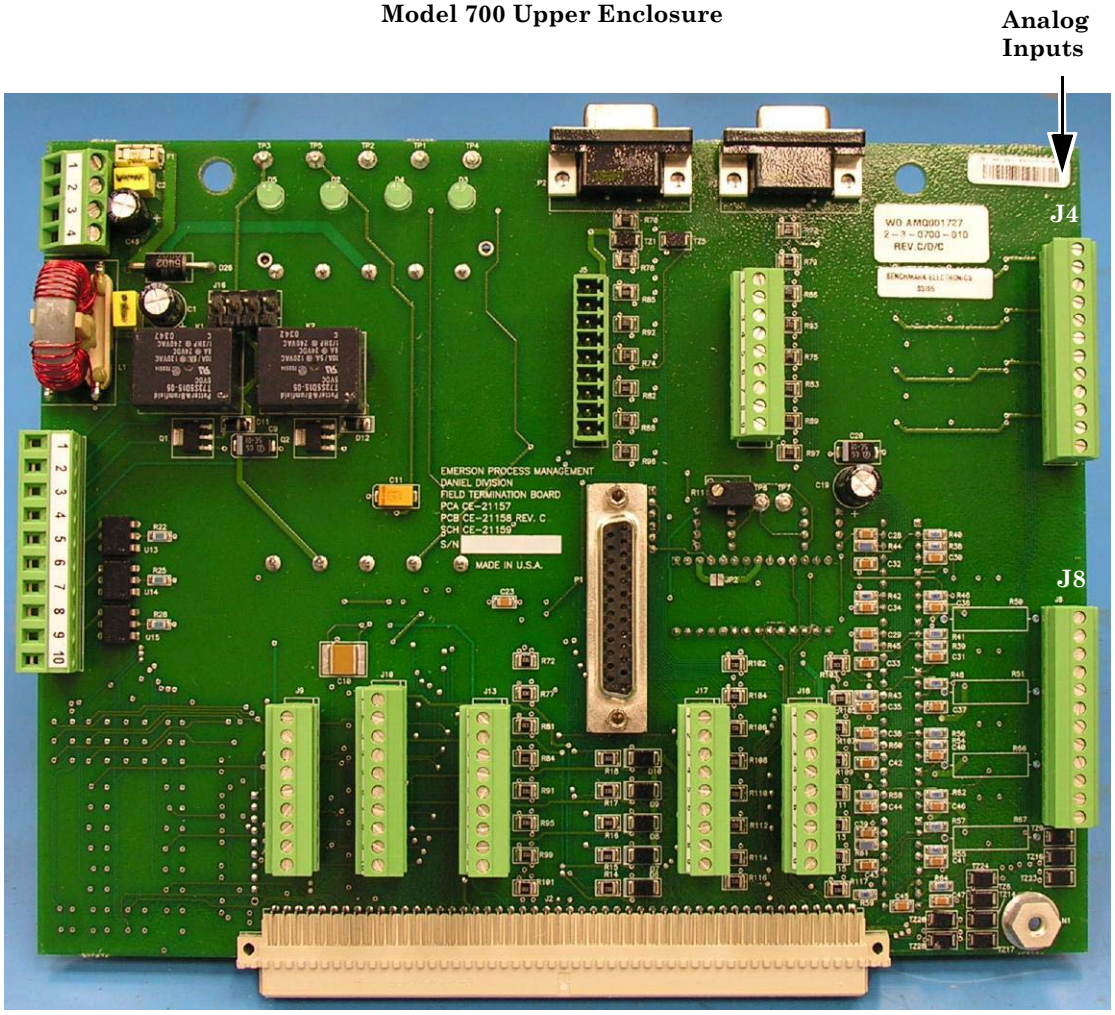


Figure 4-35 Analog Board - Inputs

The Model 700 analog inputs are configured as follows:

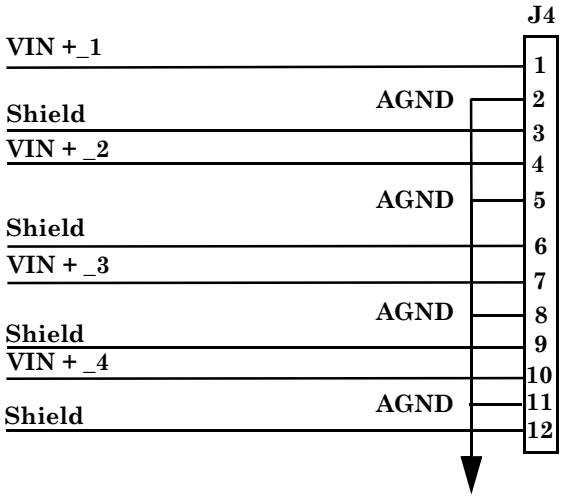


Figure 4-36 Analog Inputs

4.13.2 Analog Output Adjustment

The initial analog output adjustment will be set at the factory, before shipment, at standard values (4-20 mA). It may be necessary to check and/or adjust these values depending on output cabling/impedance. The adjustment may require two persons if the units are some distance apart. It will require a good digital meter to check the zero and full scale values at the receiving end. The scale or span value can be adjusted by a PC with the Model 700 when the values are known at the receiving end.

It is possible to calibrate the analog outputs using different engineering units, volts and percentages. For examples and detailed instructions, refer to the MON2000 *Software for Gas Chromatographs Users Manual* (P/N 3-9000-522).

4.13.3 Model 700 Analog Outputs

Standard Analog Outputs

The Model 700 has four standard analog outputs (J8 - 12-pin Phoenix connector) on the Field Termination board (P/N 3-0700-010).

Model 700 Upper Enclosure

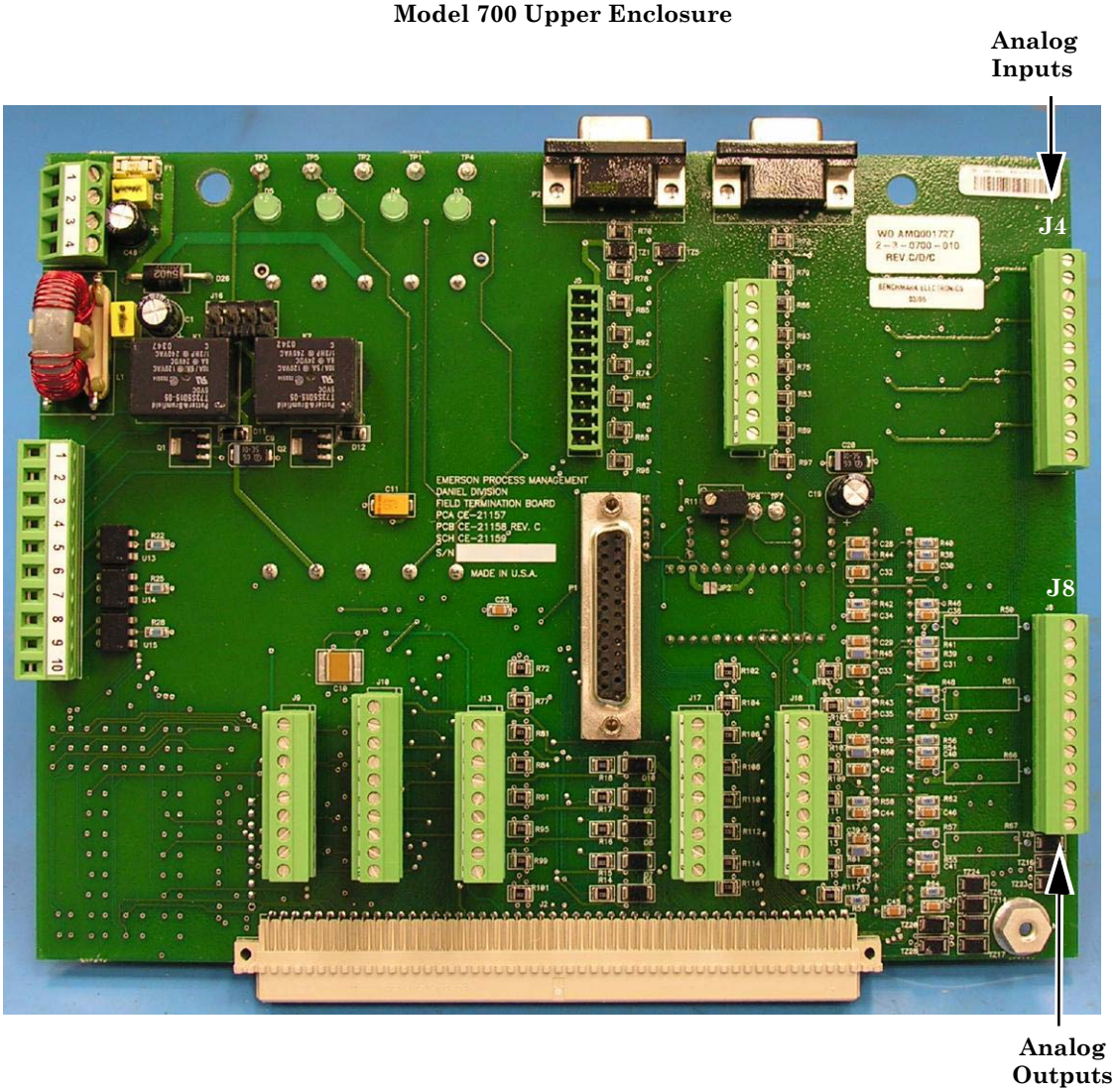


Figure 4-37 FTB Board Analog Outputs

The Model 700 analog outputs are configured as follows:

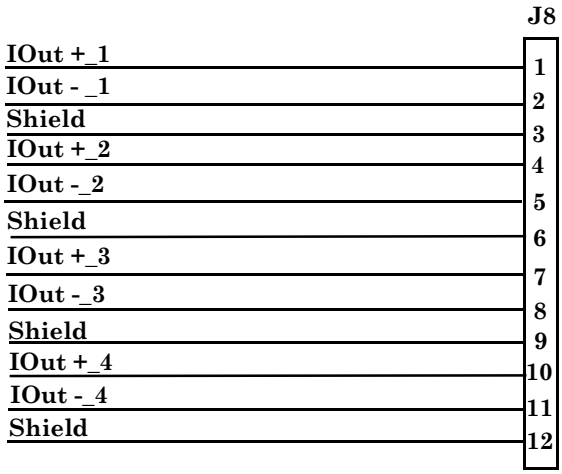


Figure 4-38 Analog Outputs

The analog outputs for the optional analog board (P/N 2-3-0580-037) are configured as follows

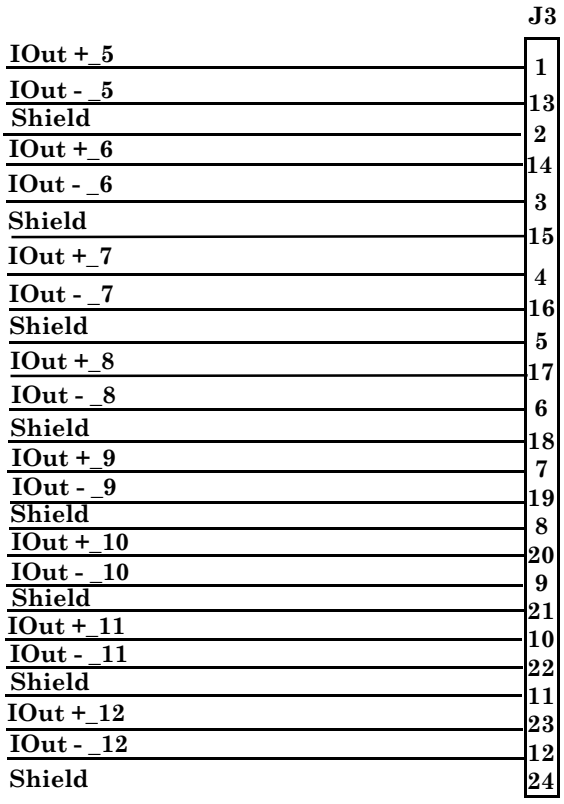


Figure 4-39 Optional Analog Board Outputs

4.14 DISCRETE DIGITAL INPUTS/OUTPUTS

For instructions on connecting digital inputs and outputs to the GC Field Termination Boards, see Section 3.4.7 for more details.

An external loopback test circuit can be built for troubleshooting the Model 700 digital input/output operation.

4.15 RECOMMENDED SPARE PARTS

See Appendix D for the lists of recommended spare parts for approximately one year of maintenance. The quantities represent the number of spares to cover most contingencies at facilities where GC systems are in operation.

Measurement Services offers service and repair service contracts that make maintaining most spares for the GC system unnecessary. Details regarding service contracts may be obtained by contacting Measurement Services at the address or telephone number on the Customer Repair Report in the back of this manual.

NOTICE

Refer to the MON2000 *Software for Gas Chromatographs User Manual,* Appendix F (P/N 3-9000-522) for BOS upgrade procedures.

4.16 UPGRADE PROCEDURES

4.16.1 Base Operating System

The Base Operating System performs functions similar to operating systems such as DOS or Windows® or Linux®.

BOS provides the basic resources and interfaces to run the user's tasks. Unlike *DOS* or Windows or *Linux*, since BOS is an embedded real-time multi-tasking preemptive operating system, there is no direct user level interface to it. If a BOS upgrade is required to your system, refer to the MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for additional BOS information.

4.16.2 Applications

The GC application, which runs under BOS, utilizes the tools provided by BOS to perform the desired gas chromatograph functions for the user. There are different applications to provide for different gas chromatographic needs. To load a new application or to upgrade an existing application refer to the MON2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522) for details.

This page is intentionally left blank.

APPENDIX A, COMMUNICATIONS SPECIFICATIONS

NOTICE

Com4 is reserved for an optional LOI. With the Com4A board installed, Com8 is used for the LOI.

Com3 is reserved for the multifunction board.

A.1 TCD SERIAL COMMUNICATIONS

The Model 700 with a TCD has three standard CPU serial communications ports: Com1, Com2, Com4, and four optional Com4A board serial ports: Com5 Com6, Com7, Com8 and Com9 for the optional internal modem. Per the matrix below, jumper settings can be configured for either RS-232, RS-422, or RS-485 serial signal definitions.

Table A-1 Matrix of Possible TCD Configurations Field Termination Board

Logical Address	Operation	Comments
Com1 and Com2 (WinSys CPU Board) J1 to FTB	RS-232, RS-422 or RS-485	PC, Flow Computer, Modem (external)
Com3 (WinSys CPU Board) J6 to Multifunction Board	RS-232	Reserved for Multifunction Board
Com4 (WinSys CPU Board) J6 to FTB	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	Unless LOI is installed, then Com 4 is reserved for the LOI
Com5 (WinSys Com4A Board) J9 (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	Modem (External)
Com6 (WinSys Com4A Board) J13 (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com7 (WinSys Com4A Board) J17 (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com8 (WinSys Com4A Board) J18 (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	Reserved for LOI, when installed
Com9		Reserved for internal modem

A.1.1 Model 700 with a TCD Comm Ports

NOTICE

A telephone modem can be connected to any of the GC serial ports configured for RS-232.

If an internal modem (WinSystems P/N 3-0580-042) or (P/N 3-0700-029 Radicom) is installed, it is assigned to serial port Com9.

If the Com4A board is installed, the modem is assigned to Com9.

With or without the Com4A board, the internal modem is assigned to Com9.

The WinSystems CPU Board has three communications ports that can be used for the PC or the Flow Computer, as the customer desires.
When a keyboard and a display is required, Com4 is used for the optional Local Operator Interface (LOI).
The four channel WinSystems Com4A board (optional) is installed for applications requiring more than three communications ports. Each channel is individually configured for RS-232, RS-422, or RS-485 (for ports Com5, Com6, Com7, and Com8).
Configuration of each channel requires installing and/or removing the appropriate line driver ICs and installing jumpers. A Chip Kit (P/N CK-75176-2) is used when configuring a single channel for RS-422 mode or when configuring a two channel (maximum) mode for RS-485.
If a modem and a serial controller are both required, an external modem will be assigned to either Com1 or to Com5.
Serial ports configured for RS-232 are most commonly used for direct serial communication between the GC and a PC or modem.
Serial ports configured for RS-422 or RS-485 are most commonly used for long distance serial communications systems, such as a DCS or a network. For these systems, the GC can communicate as a Modbus slave device.

NOTICE

In any Modbus *host-slave* DCS or network, there must only be one host to which any one of the GC serial ports can respond as a Modbus slave.

To use the MON 2000 software to configure the GC for Modbus communication, see the MON 2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

NOTICE

Model 700, Standard configuration, has three ports available on the FTB; Com 1, Com 2, and Com 5.

For further details, see Figure A-1 through Figure A-4.

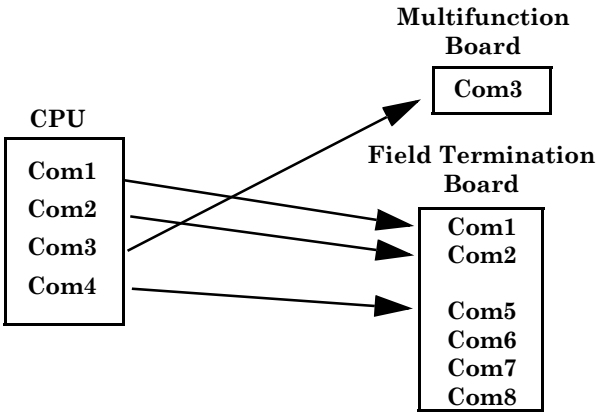


Figure A-1 Standard Configuration without LOI and Com4A Board

NOTICE

Model 700, with the LOI installed, has two communications ports available on the FTB; Com1 and Com2.

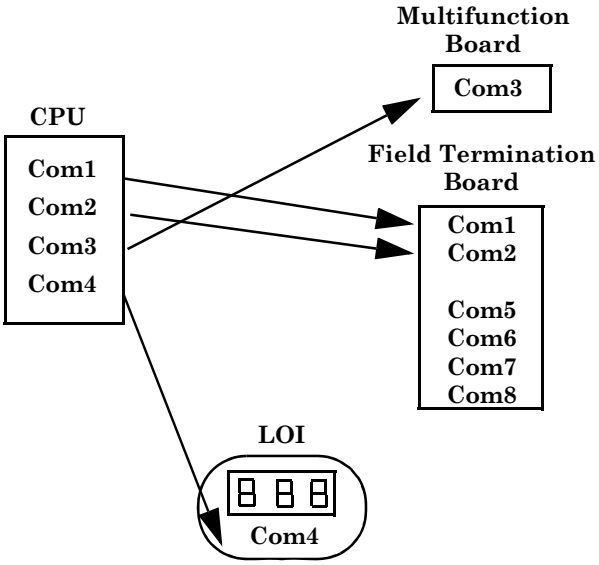


Figure A-2 Configuration with LOI

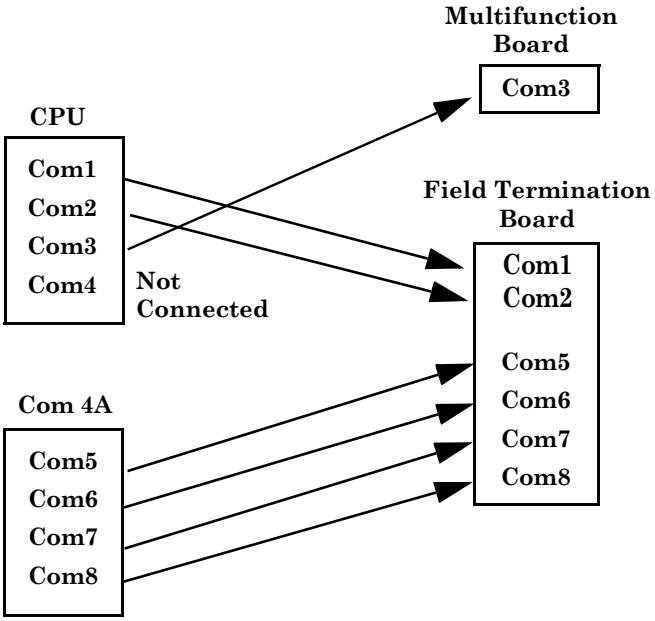


Figure A-3 Configuration with Com4A Board

NOTICE

Model 700, with the Com4A board installed, has six communications ports available on the FTB; Com1 and Com2, and Com5, Com6, Com7, and Com8.

NOTICE

Model 700, with the LOI and Com4A board installed, have six communications ports available on the FTB; Com1 and Com2, and Com5, Com6, Com7, and Com8.

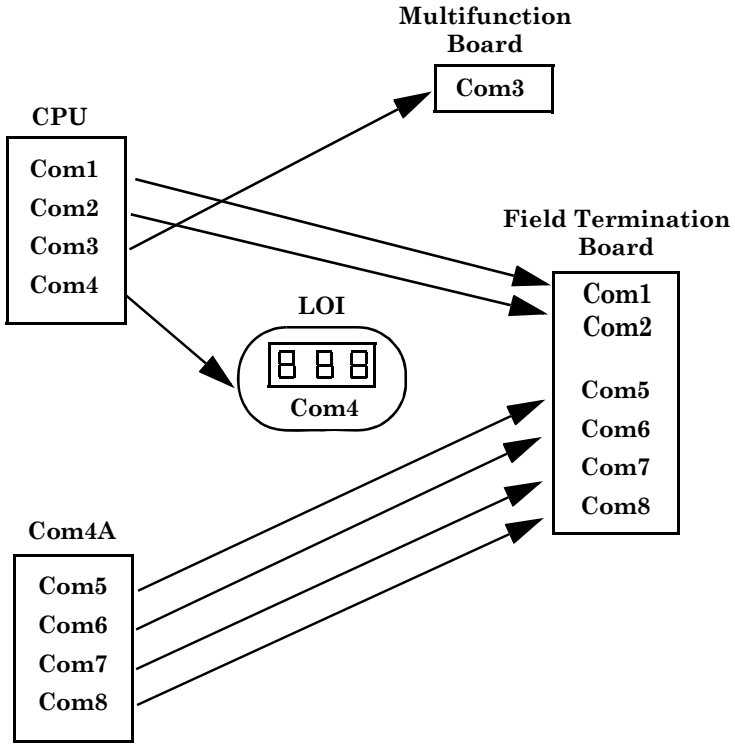


Figure A-4 Configuration with Com4A Board and LOI

If using a direct 6-conductor serial cable, connect the exposed cable leads to the FTB serial port. A pinout of a female DB 9-pin socket is shown in Figure A-5.

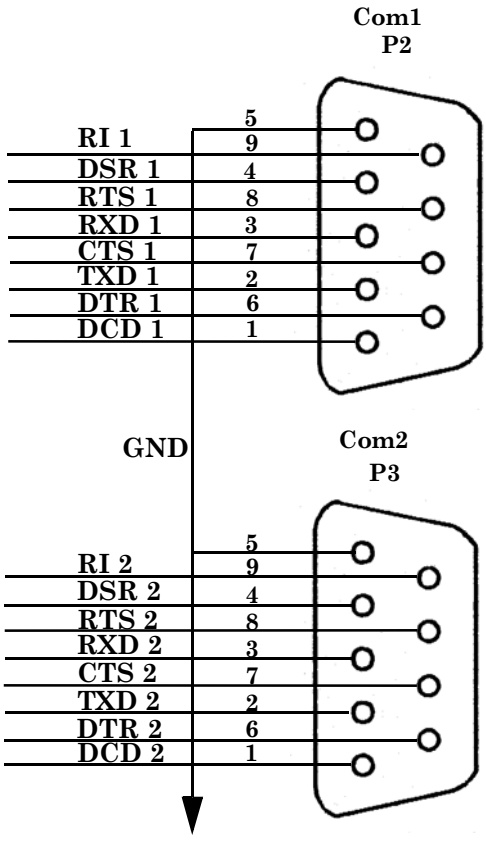


Figure A-5 FTB Com1 and Com2 DB9 Connector

NOTICE

Com3 is reserved for Multifunction board.

Com4 is reserved for the FID/TCD board.

A.2 FID SERIAL COMMUNICATIONS

The Model 700 with a FID/TCD has two standard WinSystems CPU Board serial communications ports: Com1 and Com2 that can be used for the PC or the Flow Computer, as the customer desires.

The four channel WinSystems Com4A board (optional) is installed for applications requiring more than two communications ports. Each channel is individually configured for RS_232, RS-422 or RS-485 (for ports Com5 Com6, Com7, Com8).

Table A-2 Matrix of Possible FID Configurations Field Termination Board

Logical Address	Operation	Comments
Com1 and Com2 (WinSys CPU Board) J1 to FTB	RS-232, RS-422 or RS-485	PC, Flow Computer, Modem (external)
Com3 (WinSys CPU Board) J6 to Multifunction Board	RS-232	Reserved for Multifunction PCB
Com4 (WinSys CPU Board) J6 to FID/TCD Preamplifier	RS-232	Reserved for FID/TCD Preamplifier PCB
Com5 (WinSys Com4A Board) J9 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	Modem (External)
Com5 (WinSys Com4A Board) J9 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com6 (WinSys CPU Board) J13 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com7 (WinSys Com4A Board) J17 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	
Com8 (WinSys Com4A Board) J18 on FTB (9-pin Phoenix)	RS-232, RS-422 or RS-485 (RS-422 and RS-484 needs Chip Kit #CK 75176-2)	Reserved for LOI, when installed
Com9		Reserved for internal modem

NOTICE

In any Modbus *host-slave* DCS or network, there must only be one host to which any one of the GC serial ports can respond as a Modbus slave.

To use the MON 2000 software to configure the GC for Modbus communication, see the MON 2000 *Software for Gas Chromatographs User Manual* (P/N 3-9000-522).

Configuration of each channel requires installing and/or removing the appropriate line driver ICs and installing jumpers. A Chip Kit (P/N CK-75176-2) is used when configuring a single channel for RS-422 mode or when configuring a two channel (maximum) mode for RS-485.

If a modem and a serial controller are both required, an external modem will be assigned to either Com1 or to Com5.

Serial ports configured for RS-232 are most commonly used for direct serial communication between the GC and a PC or modem.

Serial ports configured for RS-422 or RS-485 are most commonly used for long distance serial communications systems, such as a DCS or a network. For these systems, the GC can communicate as a Modbus slave device.

For further details, see Figure A-6 and Figure A-7.

NOTICE

Model 700, standard configuration, has two communications ports available on the FTB; Com1 and Com2.

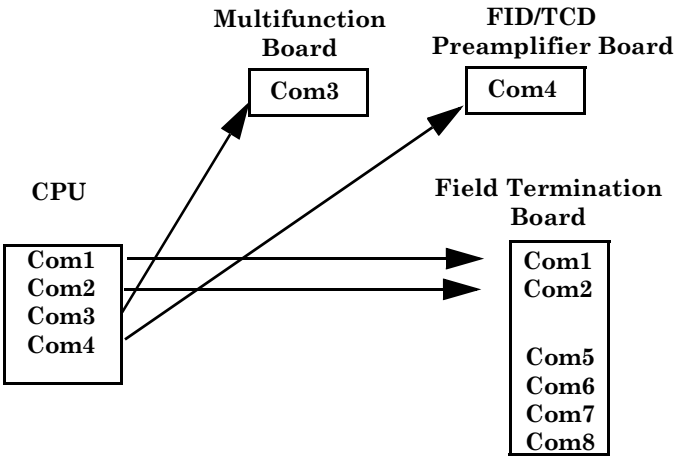


Figure A-6 Configuration without Com4A Board

NOTICE

Com 4 is dedicated to the Micro-FID/TCD Preamplifier. When the LOI becomes available, it will use a video board instead of a serial port connection.

NOTICE

Model 700, with the Com 4A board installed, has six communications ports available on the FTB; Com1 and Com2, and Com5, Com6, Com7, and Com8.

NOTICE

Com 4 is dedicated to the Micro-FID/TCD Preamplifier. When the LOI becomes available, it will use a video board instead of a serial port connection.

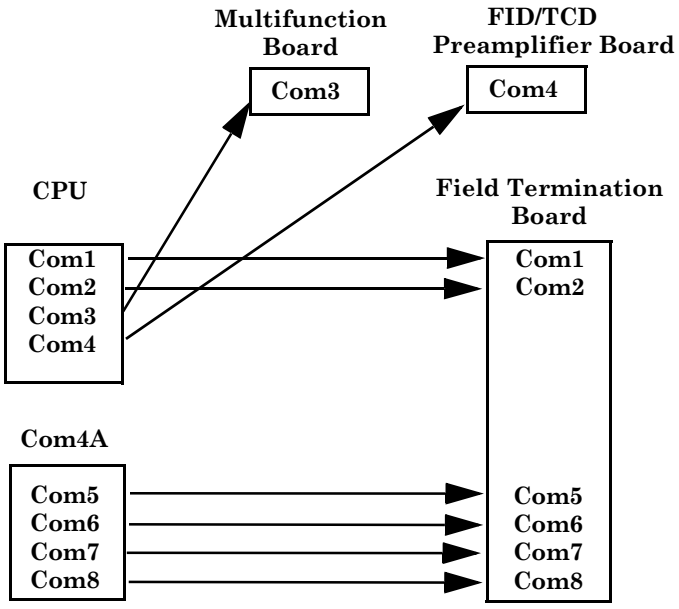


Figure A-7 Configuration with Com4A Board

NOTICE

Serial communications for FTB (Com1- Com4) is standard. Com3 reserved for the Multifunction board.

Serial communications with optional Com4A board are available on ports Com5 - Com8.

A.2.1 Connecting Serial Communications to the GC

To connect serial communications lines to the GC,

1. Access the FTB in the lower enclosure.
2. Route serial communications lines appropriately.
3. Make serial communications line connections to the FTB. See Section A.1.1 for port numbers and pinouts.

   Each of the various combinations available for GC serial communications ports (i.e., RS-232, RS-422, or RS-485) require:

   - specific jumper settings on the WinSystems CPU board or the optional Com4A board

   In most instances, installation of these jumper settings *requires no modification*. Configurations have been performed at the factory prior to shipment of the Model 700, according to customer specifications for serial communications.

NOTICE

If you are changing or adding serial communications to the GC, ensure that the correct jumpers are set.

RS-232 Ports

See Appendix A.2.2 for RS-232 port connections

Voltage: ±5 volts or ±12 volts, depending on jumper settings

Recommended Maximum Cable Length: 50 feet (15 meters)

Pinouts: See Appendix A.2.2

RS-422 Ports

See Appendix A.2.2 for RS-422 port connections.

Voltage: line drivers meet Electronics Industries Association (EIA) specifications for RS-422.

Recommended Maximum Cable Length: 4000 feet (1219 meters)

Pinouts: See Appendix A.2.2

RS-485 Serial Specifications

See Appendix A.2.2 for RS-485 port connections.

Voltage: line drivers meet Electronics Industries Association (EIA) specifications for RS-485

Recommended Maximum Cable Length: 4000 feet (1219 meters)

Pinouts: See Appendix A.2.2

A.2.2 FTB Serial Communications

The settings are shown in Figure A-8 through Figure A-13.

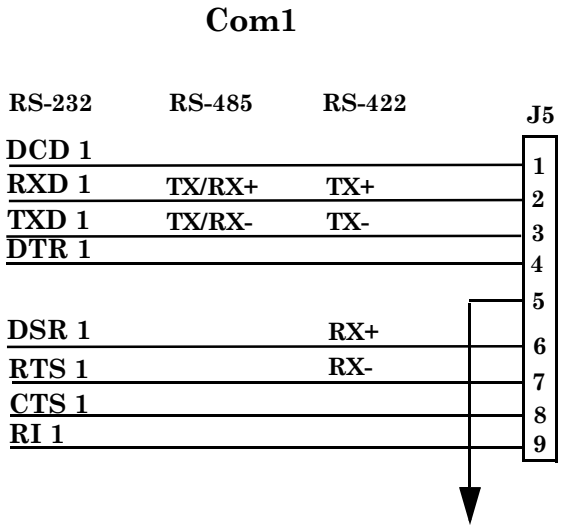


Figure A-8 FTB Com1 DB 9-pin Phoenix Connector

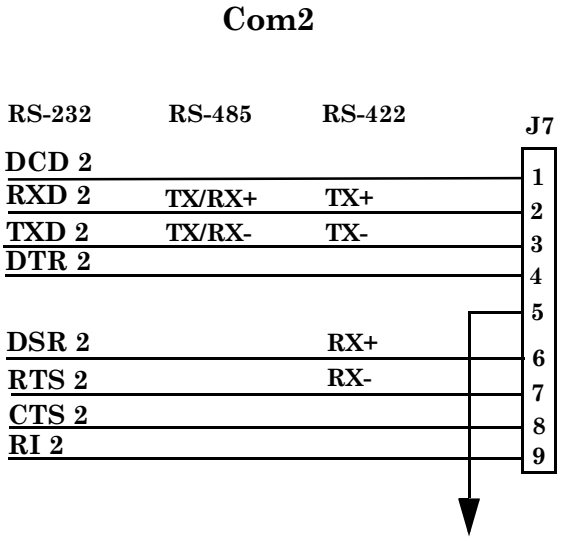


Figure A-9 FTB Com2 DB 9-pin Phoenix Connector

Com5

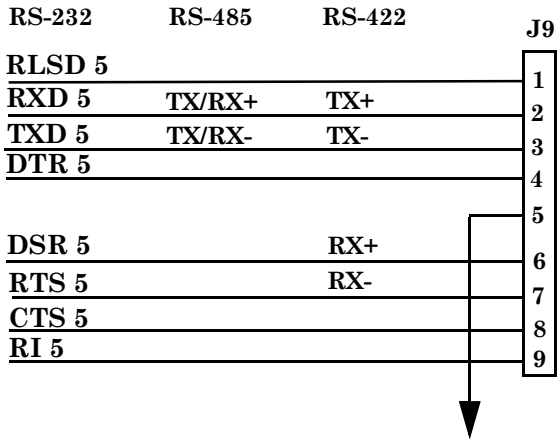


Figure A-10 FTB Com5 DB 9-pin Phoenix Connector

Com6

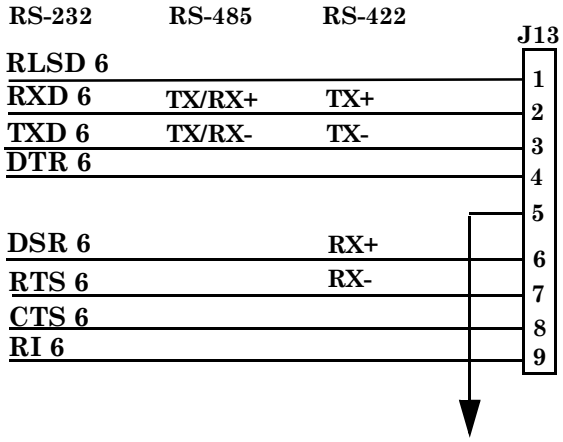


Figure A-11 FTB Com6 DB 9-pin Phoenix Connector

Com7

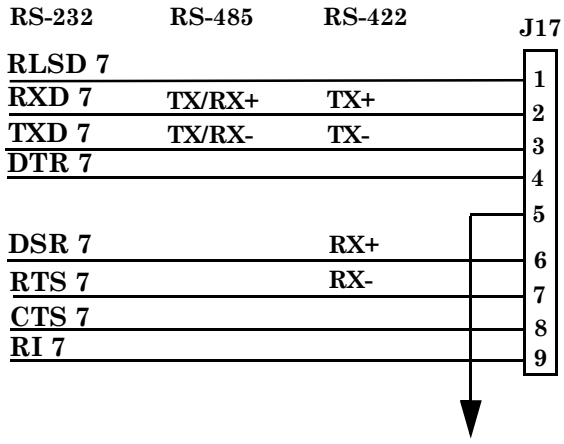


Figure A-12 FTB Com7 DB 9-pin Phoenix Connector

Com8

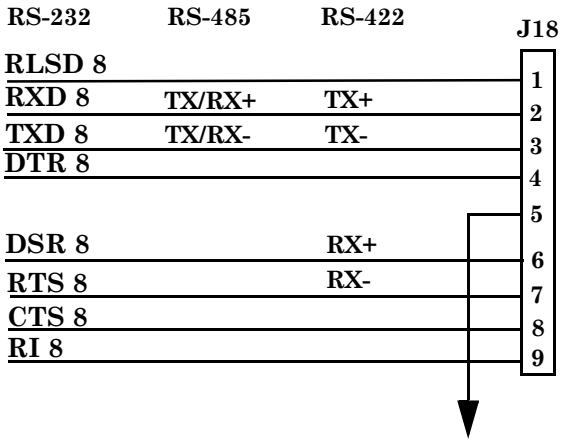


Figure A-13 FTB Com8 DB 9-pin Phoenix Connector

WinSystems CPU

Jumper settings and pinouts for the four WinSystems CPU board serial communications ports; Com1, Com2, Com3, and Com4 are defined in the following tables.

Table A-3 Communication with WinSystems CPU

Com1

RS-232 Mode
J8 – Jumpers Pins 1 and 2
J13 – No jumpers
U2 – Installed (Standard)
U5 – Removed
U6 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J8 – Jumper Pins 1 and 2
J13 – No jumpers
U2 – Removed
U5 – Installed
U6 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J8 – Jumper Pins 1 and 2
J13 – Jumper Pins 2 and 3
U2 – Removed
U5 – Removed
U6 – Installed

Table A-4 Communication with WinSystems CPU

Com2
RS-232 Mode
J9 – Jumpers Pins 1 and 2
J16 – No jumpers
U9 – Installed (Standard)
U11 – Removed
U12 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J9 – Jumper Pins 1 and 2
J16 – No jumpers
U9 – Removed
U11 – Installed
U12 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J9 – Jumper Pins 1 and 2
J16 – Jumper pin 2 and 3
U9 – Removed
U11 – Removed
U12 – Installed

Table A-5 Communication with WinSystems CPU

Com3 Reserved for Multifunction Board
RS-232 Mode
J12 – Jumpers Pins 1 and 2
J14 – No jumpers
U4 – Installed (Standard)
U7 – Removed
U8 – Removed

Table A-6 Communication with WinSystems CPU

Com4 (Reserved for FID/TCD Preamplifier Board)

RS-232 Mode
J15 – Jumpers Pins 1 and 2
J17 – No jumpers
U10 – Installed (Standard)
U13 – Removed
U14 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J15 – Jumpers Pins 1 and 2
J17 – No jumpers
U10 – Removed
U13 – Installed
U14 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J15 – Jumpers Pins 1 and 2
J17 – Jumpers Pins 2 and 3
U10 – Removed
U13 – Removed
U14 – Installed

WinSystems MCM/LPM – Com4A Board

Jumper settings and pinouts for the four WinSystems Com4A board (optional) serial communications ports; Com5, Com6, Com7, and Com8 are defined in the following tables.

Table A-7 Communication with WinSystems MCM/LPM – Com4A Board (Optional)

Com5
RS-232 Mode
J2 – No jumpers
U6 – Installed (Standard)
U3 – Removed
U4 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J2 – No jumpers
U6 – Removed
U3 – Installed
U4 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J2 – Jumper Pins 2 and 3
U6 – Removed
U3 – Removed
U4 – Installed

Com6
RS-232 Mode
J5 – No jumpers
U13 – Installed (Standard)
U10 – Removed
U14 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J5 – No jumpers
U13 – Removed
U10 – Installed
U14 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J5 – Jumper pins 2 and 3
U13 – Removed
U10 – Removed
U14 – Installed

Com7

RS-232 Mode
J4 – No jumper
U11 – Installed (Standard)
U9 – Removed
U12 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J4 – No jumpers
U11 – Removed
U9 – Installed
U12 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J4 – Jumper pins 2 and 3
U11 – Removed
U9– Removed
U12 – Installed

Com8
RS-232 Mode
J1 – No jumpers
U5 – Installed (Standard)
U1 – Removed
U2 – Removed
RS-422 Mode (Need WinSys Chip Kit CK # 75176-2)
J1 – No jumpers
U5 – Removed
U1 – Installed
U2 – Installed
RS-485 Mode (Need WinSys Chip Kit CK # 75176-2)
J1 – Jumper pins 2 and 3
U5 – Removed
U1 – Removed
U2 – Installed

Com4A Board Compatibility Settings

Table A-8 J10 Jumper Settings

Pin(s)	Position
1 and 2	In
3 and 4	In
7 and 8	In
9 and 10	In

Table A-9 J7 Jumper Settings

Pin(s)	Position
1 and 2	Open
3 and 4	Open
5 and 6	Open

Table A-10 J8 Jumper Settings

Pin(s)	Position
1 and 2	In
3 and 4	In
5 and 6	In
7 and 8	In

Table A-11 J9 Jumper Settings

Pin(s)	Position
1 and 2	In
5 and 6	In

WinSystems Ethernet Board

The PCM-NE2000-16 PC-104 can be configured by using the on-board jumper block Jumper settings and pinouts used on the Model 700 for the PCM-NE-2000-16 PC-104 Ethernet board (optional) are defined in the following table:

Table A-12 Ethernet Board Pin Settings

Jumper	Pin Position "In"
J1	13 and 14 15 and 16 17 and 18 23 and 24 27 and 28
J2	1 and 2
J3	1 and 2

Radicom 56K Baud Modem Board

The jumper settings and pinouts for the Radicom Modem (P/N 3-0700-029) are shown below: (see Section 3.4.10).

Table A-13 J26 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table A-14 J27 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table A-15 J30 Radicom Modem Jumper Settings

Pin(s)	Position
1 and 2	In

Table A-16 J31 Radicom Modem Jumper Settings

Pin(s)	Position
2 and 3	In

A.3 WIRING LOCAL RS-232 COMMUNICATIONS

A.3.1 GC Serial Port and Cable Configurations

This section provides more detailed information about local serial port connections for the Model 700. It identifies serial port pin assignments and diagrams for designing RS-232 serial cables.

GC serial ports are found on the Field Termination Board and the connection points for external devices are as follows:

Model 700 Lower Enclosure

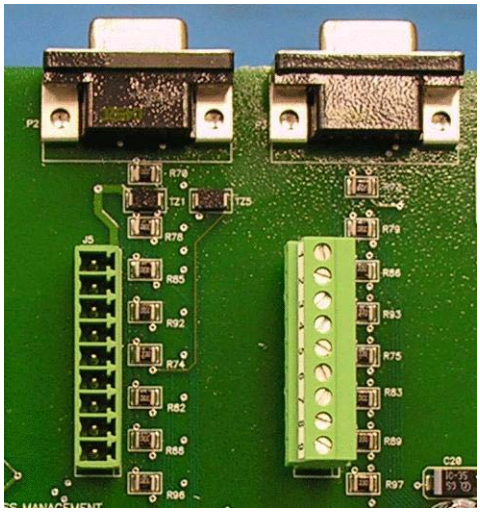


Figure A-14 FTB Serial Connections

Model 700 Lower Enclosure

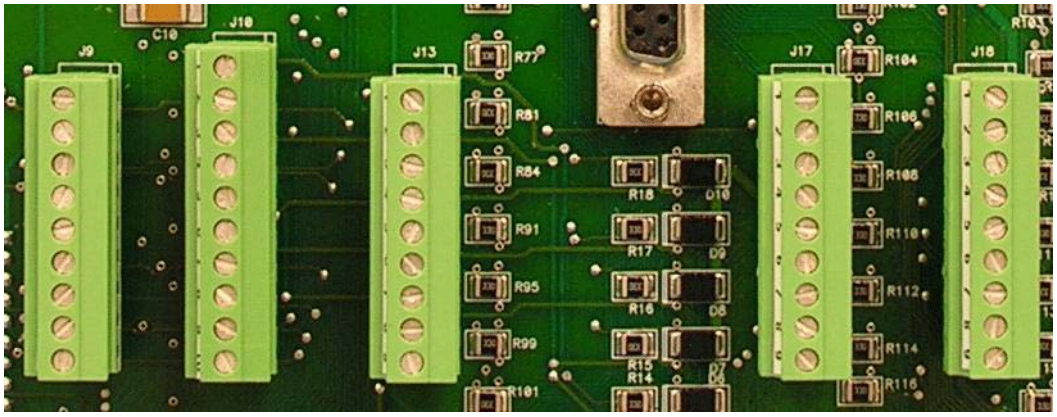


Figure A-15 FTB Serial Connections

Table A-17 Serial Ports on Field Termination Board

Port	Comments	Phoenix Plug (bare-wire) connection
Serial Port 1 (Com1)	P2 DB 9-pin Connection	J5
Serial Port 2 (Com2)	P3 DB 9-pin Connection	J7
Serial Port 3 (Com3)	Reserved for Multifunction Board	N/A
Serial Port 4 (Com4)	Reserved for LOI with Com4A board (TCD units) Reserved for FID/TCD Preamplifier Board (FID/TCD units)	N/A
Serial Port 5 (Com5)		J9
Serial Port 6 (Com6)		J13
Serial Port 7 (Com7)		J17
Serial Port 8 (Com8)		J18

Phoenix plug (bare-wire) connections are available to all four serial ports. Pin-outs are identical for all four serial port Phoenix plugs and jacks. Each Phoenix plug/jack (male) combination allows a bare-wire connection and uses 9-Pins as illustrated:

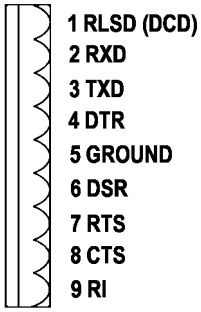


Figure A-16 Phoenix Connector (J5, J6, J10, and J11) Pinout

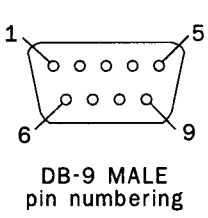
Null modem connections (DB 9-pin) are available for Serial Ports 1 and 2 only, as noted in Table A-17.

NOTICE

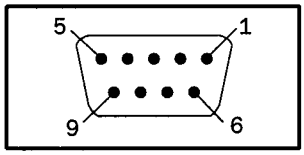
PC-to-GC connections, direct serial:
The GC serial ports were wired to appear as DCE, so a straight-through serial cable is used for a direct serial connection between the GC and the PC. (The PC is Data Terminal Equipment, or DTE.) See Section A.3.2.

External modem-to-GC connections, serial: a null modem cable and gender changes may be purchased from any computer products store, for the GC to external modem connection. However, a custom serial cable may be built to emulate a null-modem cable for a connection between the GC Controller and an external modem. (The modem is Data Communications Equipment, or DCE.) See Section A.4.

Both of the GC DB 9-pin jacks are female and have identical pin assignments. Note that a DB 9-pin male numbering scheme is also illustrated, but for reference purposes only as follows (see Figure A-17).



DB-9 MALE
pin numbering



DB-9 FEMALE
socket numbering

pinout for both DB-9 female jacks at GC Controller

5	4	3	2	1
GND	DSR	RxD	TxD	RLSD
9	8	7	6	
RI	RTS	CTS	DTR	

Figure A-17 DB 9-pin Connector (P2 and P3) and Pinout for Jacks

A.3.2 GC DB 9-pin Serial Port to PC DB 9-pin Port

To make an RS-232 serial connection between one of the DB 9-pin serial ports of the GC, and a PC with DB 9-pin serial port, use a straight-through serial cable, terminated as DB 9-pin male / DB 9-pin female. This will work if the PC has a male DB 9-pin serial port, and its pin assignments are identical to those found on a typical DB 9-pin serial port of an IBM PC.

The straight-through serial cable can be obtained from most computer products suppliers, so custom-building a cable normally is not necessary. Wiring and signal paths are illustrated as follows (see Figure A-18).

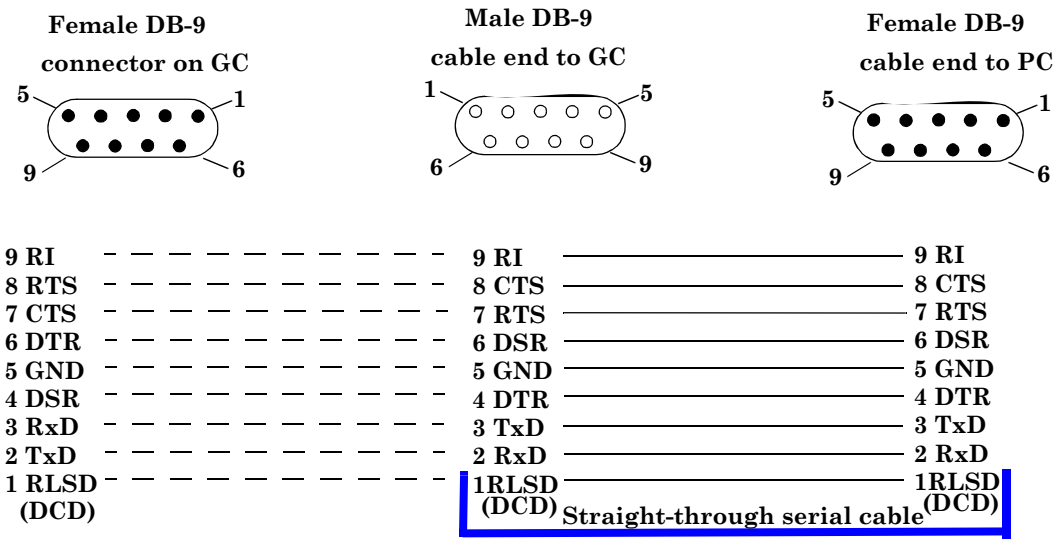


Figure A-18 GC DB 9-pin Port to PC DB 9-pin Port

A.3.3 GC DB 9-pin Serial Port to PC DB 25-pin Port

To make an RS-232 serial connection between one of the DB 9-pin serial ports of the GC, and a PC with DB 25-pin serial port, you may be able to use a straight-through serial cable, terminated as DB 9-pin male / DB 25-pin female. This will work if the PC has a male DB 25-pin serial port, and its pin assignments are identical to those found on an IBM PC. The necessary straight-through serial cable can be obtained from most computer products suppliers, so custom-building a cable normally is not necessary. Wiring and signal path are illustrated as follows (see Figure A-19).

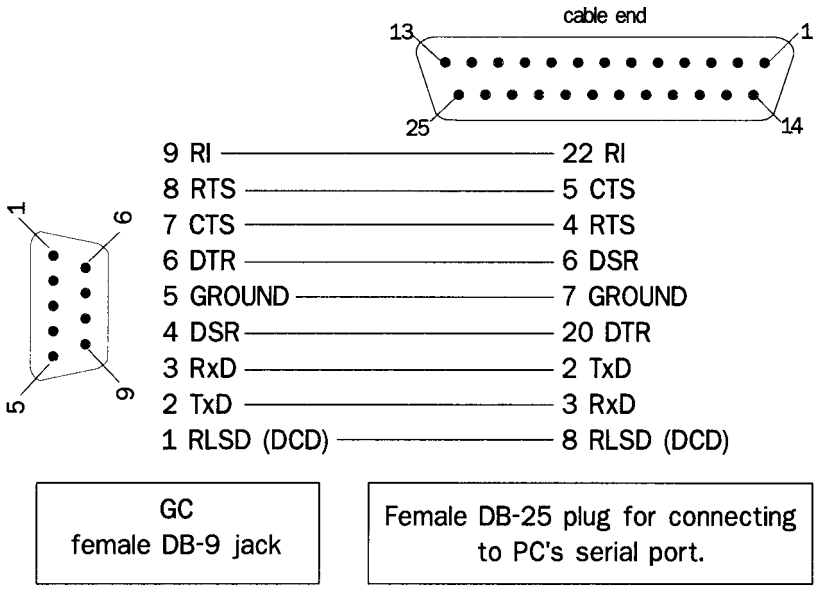


Figure A-19 GC DB 9-pin Port to PC DB 25-pin Port

NOTICE

The cable for this application is also available (P/N 3-2350-068) in a customer-specified length with six exposed leads and a female DB 9-pin connector.

A.3.4 GC PHOENIX Plug Port to PC DB 9-pin Port

To make an RS-232 serial connection between one of the Phoenix Plug serial ports of the GC, and a PC with DB 9-pin serial port, you will need to manufacture the cable and its DB 9-pin, female plug cable end as illustrated below (see Figure A-20).

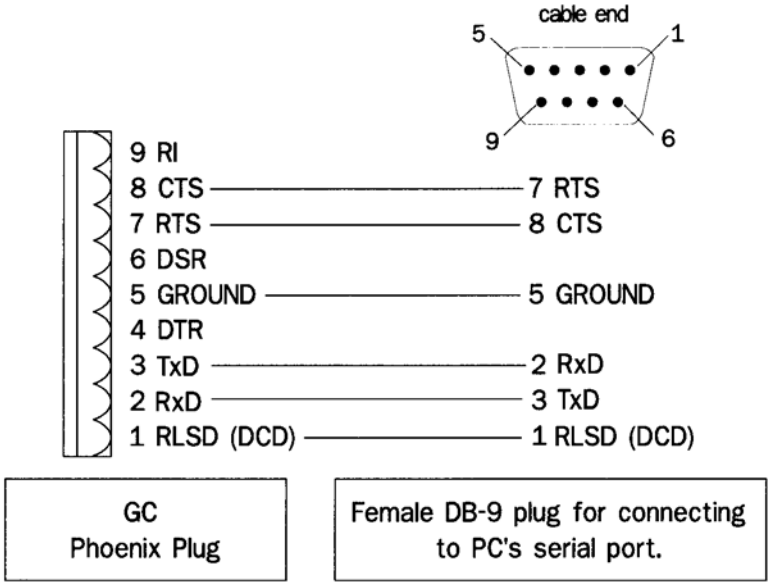


Figure A-20 GC DB 9-pin Port to PC DB 25-pin Port

A.3.5 GC PHOENIX Plug Port to PC DB 25-pin Port

To make an RS-232 serial connection between one of the Phoenix Plug serial ports of the GC, and a PC with DB 25-pin serial port, you will need to manufacture the cable and its DB 25-pin, female plug cable end as illustrated below (see Figure A-21).

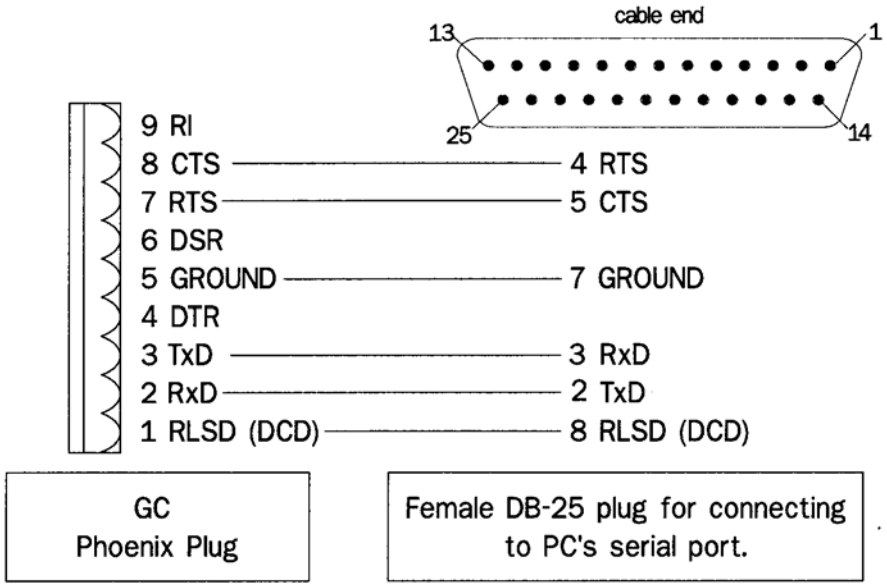


Figure A-21 GC Phoenix Plug Port to PC DB 25-pin Port

A.4 WIRING REMOTE RS-232 COMMUNICATIONS

A.4.1 GC DB 9-pin Serial Port to Modem DB 25-pin Port

To make an RS-232 serial connection between one of the DB 9-pin serial ports of the GC, and an external modem with a DB 25-pin serial port, you may use gender changes and a null modem cable purchased from any computer products supplier, or you may manufacture a cable. The manufactured null modem cable will need a male DB 9-pin connector and a male DB 25-pin connector. Wire the cable ends as illustrated below (see Figure A-22).

NOTICE

The DB-9 connector on the GC serial port is wired to appear as Data Communications Equipment (DCE). Use a custom null-modem type cable to make the connection between the GC and an external modem. (GC serial ports were wired to appear as DCE so that a straight-through serial cable could be used for a direct serial connection between the GC Controller and the PC, which is Data Terminal Equipment [DTE].)

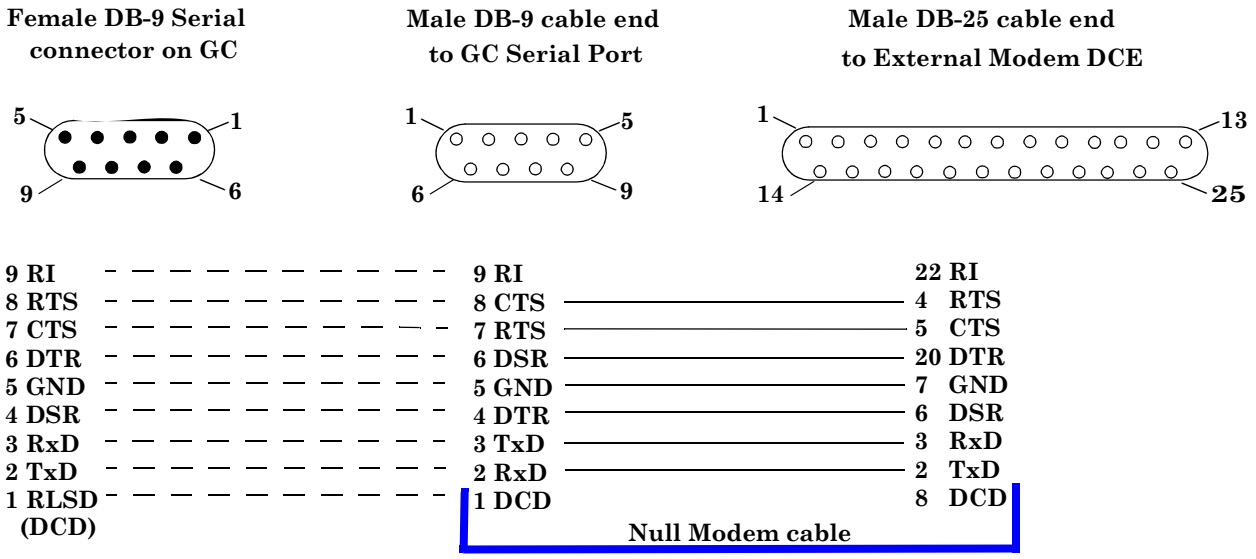


Figure A-22 GC DB 9-pin Port to External Modem DB 25-pin Port

A.4.2 GC PHOENIX Plug to Modem DB 25-pin Port

To make an RS-232 serial connection between one of the Phoenix Plug serial ports of the GC, and an external modem with DB 25-pin serial port, you will need to manufacture the cable and its DB 25-pin, male plug cable end as illustrated below (see Figure A-23).

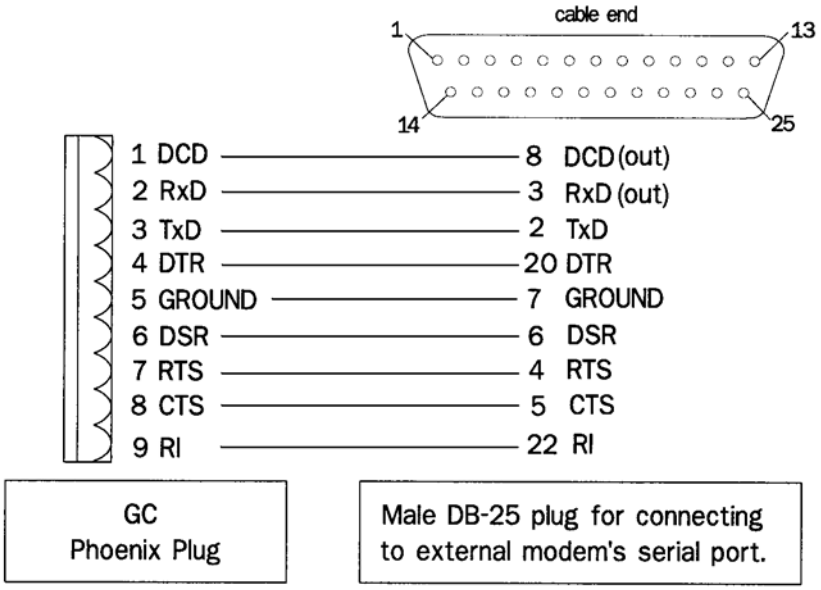


Figure A-23 GC Phoenix Plug Port to External Modem DB 25-pin Port

A.5 EXAMPLE RS-422 PC-GC CONNECTION

NOTICE

See Section 3.4 for additional details about serial communication setups.

This section demonstrates an example RS-422 connection from a PC to GC that is accomplished through use of an asynchronous line driver/interface device. The line driver device serves as an interface between the RS-232 output of the PC and the RS-422 protocol needed for long distance serial input to the GC. Specifics of the line driver are as follows:

- Black Box brand
- Model LD485A-MP RS-232/RS-485 Multipoint Line Driver
- RS-232 input (to connect to the PC)
- RS-422 or RS-485 output (to connect to the GC)

NOTICE

For this example, a straight-through RS-232 serial cable is used to connect between the PC and the line driver.

RS-422 line terminations are illustrated in Figure A-24, below, and jumper and switch settings to configure the line driver device are listed in Table A-18 and Table A-19.

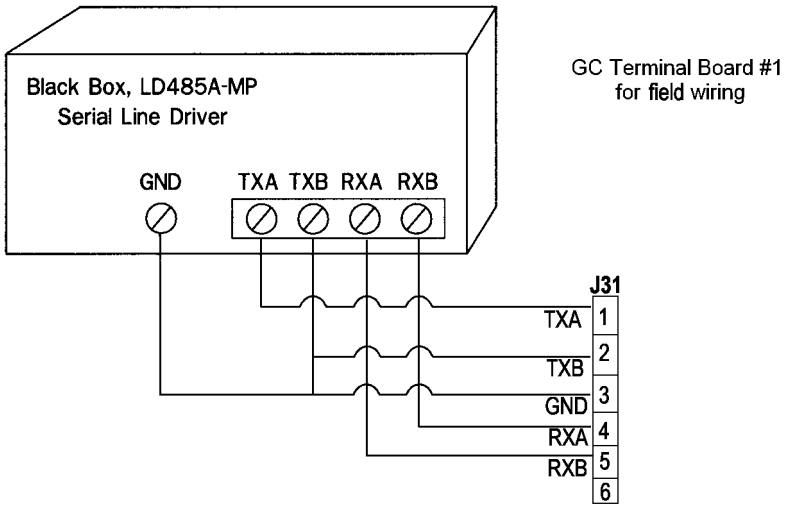


Figure A-24 Example RS-422 Serial Cable Terminations

Table A-18 Switch Settings for LD485A-MP, RS-422 to GC

Switch Type	Label	Position	Purpose
Front Panel Switch	NORMAL / DLB	NORMAL	Uses normal operation, instead of loopback testing.
DIP Switch Bank	XW1A DCE / XW1B DTE	XW1A DCE	Sets line driver to operate as data communications equipment (DCE).
DIP Switch Bank	S2	UNTERM	Eliminates need for resistor network termination to connect one PC directly to one GC.

Table A-19 Jumper Settings for LD485A-MP, RS-422 to GC

Jumper	Position	Purpose
W8	HALF	half duplex operation
W9	ON	no delay, clear to send (CTS) always true
W15	A-B	RS-485 driver enabled by request to send (RTS)
W16	A-B	half duplex turnaround delay at 5 ms
W17	B 100 ms	disable timeout delay by 100 ms
W18	B-C	RS-485 driver enabled by RTS

NOTICE

See Section 3.4 for additional details about serial communication setups.

A.6 EXAMPLE RS-485 PC-GC CONNECTION

This section demonstrates an example RS-485 connection from a PC to GC that is accomplished through use of an asynchronous line driver/interface device. The line driver device serves as an interface between the RS-232 output of the PC and the RS-485 protocol needed for long distance serial input to the GC. Specifics of the line driver are as follows:

- Black Box brand
- Model LD485A-MP RS-232/RS-485 Multipoint Line Driver
- RS-232 input (to connect to the PC)
- RS-422 or RS-485 output (to connect to the GC)

NOTICE

For this example, a straight-through RS-232 serial cable is used to connect between the PC and the line driver.

Refer to Figure A-25 and Figure A-26 for RS-485 line terminations, jumpers and switch settings to configure the line driver device (also listed in Table A-19).

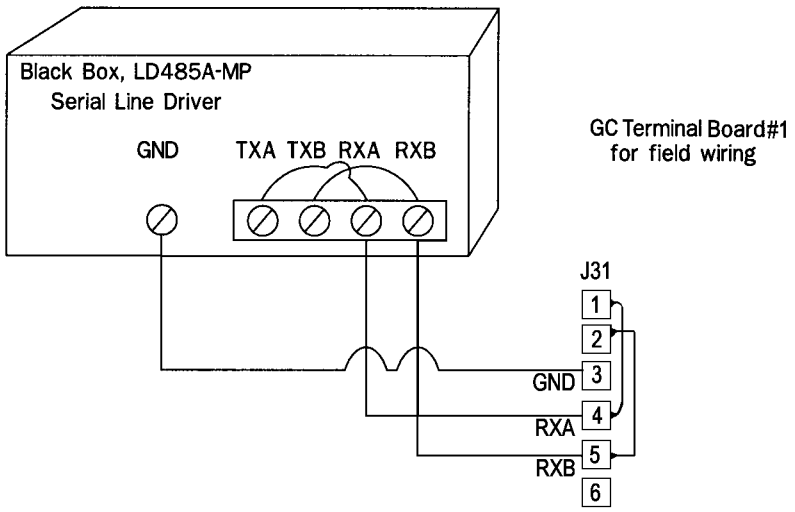


Figure A-25 Example RS-485 Serial Cable Terminations, Line Driver to GC Controller Com3

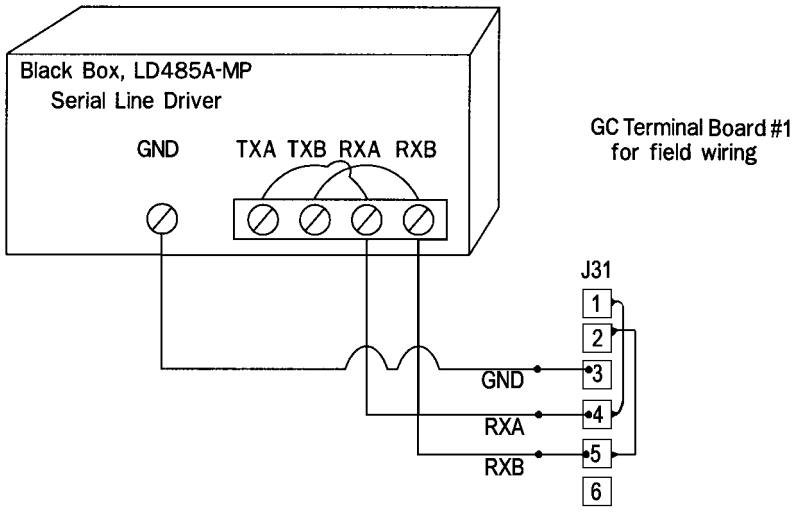


Figure A-26 Example RS-485 Serial Cable Terminations, Line Driver to GC Controller Com4

Table A-20 Switch Settings for LD485A-MP, RS-485 to GC

Switch Type	Label	Position	Purpose
Front Panel Switch	NORMAL / DLB	NORMAL	Normal operation used, instead of loopback testing.
DIP Switch Banks	XW1A DCE / XW1B DTE	XW1A DCE	Sets line driver to operate as data communications equipment (DCE).
DIP Switch Banks	S2	UNTERM	Eliminates need for resistor network termination to connect one PC directly to one GC.

Table A-21 Jumper Settings for LD485A-MP, RS-485 to GC

Jumper	Position	Purpose
W8	HALF	half duplex operation
W9	0 ms	0 milliseconds delay from time request to send (RTS) received as true until clear to send (CTS) asserted as true
W15	A-B	RS-485 driver enabled by RTS
W16	A-B	half duplex turnaround delay at 5 ms
W17	B 100 ms	disable timeout delay by 100 ms
W18	B-C	RS-485 driver enabled by RTS

This page is intentionally left blank.

NOTICE

Revision C of the Internal Modem requires MON2000 software, version 2.2 or later.

APPENDIX B, MODEM INSTALLATION

This appendix provides information for installing the optional Internal Modem for the Model 700 (P/N 3-0700-029). The modem communications is established via COM4 and the MON2000 version 2.2 software, which then redirects modem communications through to Com9.

B.1 OPTIONAL INTERNAL MODEM

⚠WARNING

DANGER TO PERSONNEL AND EQUIPMENT

Before removing the cover from the GC, ensure that the power supply switch is OFF and the AC power cord is disconnected.

Failure to follow this warning may result in injury or death to personnel or cause damage to the equipment.

To install the internal modem,

1. Halt any ongoing analysis runs.
2. Disconnect the power from the unit.
3. Remove the explosion-proof dome and the Oven System protective cover.

4. Disconnect the Analog cable from J6 of the System Interface board, then disconnect all CPU cables from the System Interface board.
5. Remove the CPU assembly and install the modem, with associated hardware into J19 and J20 PC/104 Bus connector on the CPU assembly. The modem must be the top board in the assembly. See Figure below.

Model 700 Lower Enclosure

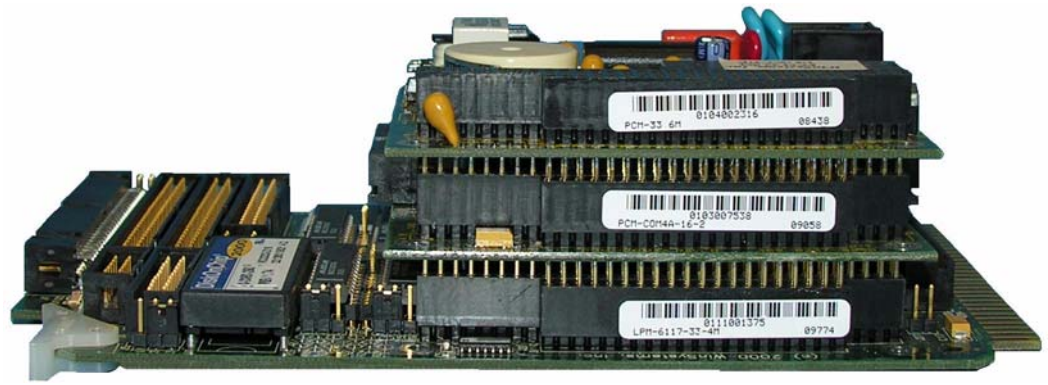


Figure B-1 Radicom 56K Baud Modem Installation

6. Set communication port jumper settings on the modem board (P/N 3-0700-029) as follows:

Jumper	Pin
J26	1-2
J27	1-2
J30	1-2
J31	2-3

7. Plug one end of the modem extension cable (P/N 3-2350-075) into RJ11 of the modem assembly. The in-line jack on the remaining end of the modem extension cable attaches to the lower left inside wall of the card cage shield (after the CPU assembly is reinstalled and all cables reconnected to the System Interface board). No software setup is required for this board.
8. Insert the phone line into the modem extension assembly.

B.1.1 Optional Ethernet Board

To add an Ethernet Assembly:

1. Disconnect the Analog cable from J6 of the FTB, then disconnect all CPU and optional board cables and lines.
2. Remove the CPU assembly and install the Ethernet assembly with associated hardware into J19 and J20 PC/104 Bus connector on the CPU assembly. If an option board is already plugged into the PC/104 Bus on the CPU, install the Ethernet assembly and mounting hardware into the PC/104 Bus connector on the option board.
3. Plug one end of the Ethernet extension cable (P/N 3-2350-088) into J5 of the Ethernet assembly. The in-line jack on the remaining end of the Ethernet extension cable attaches to the lower left inside wall of the card cage shield, after the CPU assembly is reinstalled and all cables and lines reconnected. No software setup is required for this board.
4. Run the Ethernet line through the conduit into the lower enclosure and connect it to the Ethernet extension cable.

This page is intentionally left blank.

APPENDIX C, MANIFOLD CARRIER FOR GAS BOTTLES

C.1 CARRIER GAS

NOTICE

The illustration and information in this appendix are adapted from drawing AE-10098.

This appendix provides a description of the carrier manifold (P/N 3-5000-050) that permits connection of two carrier gas bottles, or cylinders, to a gas chromatograph (GC) system. The benefits of this manifold are as follows:

- When one bottle is nearly empty (i.e., 100 psig remaining), the other bottle becomes the primary supply.
- Each bottle can be disconnected for refilling without interrupting GC operation.

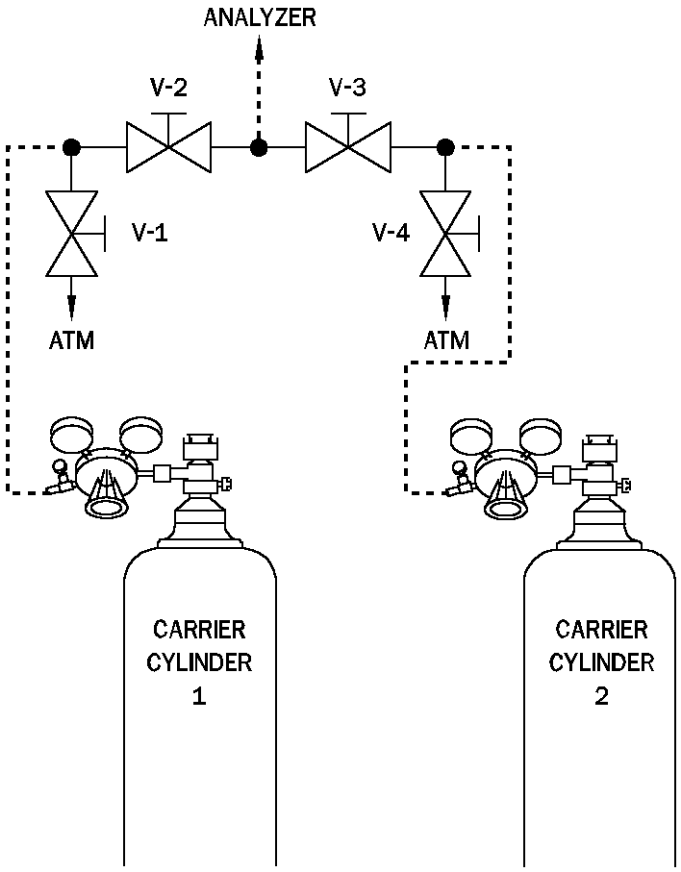


Figure C-1 Manifold for Two Carrier Gas Bottles to GC System

C.2 INSTALLATION AND LINE PURGING

To install and purge the dual-bottle carrier gas manifold, proceed as follows:

1. Install manifold as shown in Figure C-1. Close all valves and tighten all fittings. Run tubing to the Analyzer, but do not connect.
2. Back off pressure regulator (counter clockwise) fully.
3. Open cylinder valve for Carrier Cylinder 1. The pressure indicator will read the cylinder pressure.
4. Open the shut-off valve attached to the carrier regulator.
5. Regulate pressure out of the cylinder to 20 psig, then close the cylinder valve.
6. Open V-1 (bleed valve) and let the carrier gas bleed to atmosphere until both gauges read 0 psig, then close V-1.
7. Repeat Steps 4 and 5 two more times to purge the line to V-2.
8. Purge the line to V-3 by repeating Steps 2 through 6; but this time, use bleed valve V-4 and Carrier Cylinder 2.
9. With valves 1-4 closed, open both cylinder valves and regulate both carriers to approximately 10 psig.
10. Open V-2 and V-3 simultaneously, then turn both cylinder valves off and let the carrier gasses bleed through the line to the Analyzer until all gauges read 0 psig.
11. Repeat steps (8) and (9) two more times to purge line to Analyzer.
12. Close V-3, leave V-2 open.

13. Open cylinder valve of Carrier Cylinder 1 and, with carrier gas flowing at 10 psig or below, connect carrier line to Analyzer.
14. Slowly regulate Carrier Cylinder 1 to 110 psig.
15. Open V-3 and slowly regulate Carrier Cylinder 2 to 100 psig. (By doing this, all but 100 pounds of Carrier Cylinder 1 will be used before any of Carrier Cylinder 2 is used. When Carrier Cylinder 1 gets to 100 pounds, replace the cylinder). Leak-check all of the fittings carefully.
16. Let the Analyzer run overnight before calibrating.

C.3 REPLACING CARRIER CYLINDER

To replace one carrier cylinder without interrupting GC operation, proceed as follows:

1. Turn cylinder valve off.
2. Back off on cylinder pressure regulator until handle turns freely. Remove cylinder.
3. Attach new cylinder to regulator and repeat Steps 3 through 7 of Installation Instructions, Section C.2, using appropriate bleed valve to purge line. Leak-check the fitting.
4. Open the appropriate block valve to the Analyzer (V-2 or V-3) and regulate outlet pressure to appropriate level. (See Steps 14 and 15 of Installation Instructions, Section C.2.)

C.4 CALIBRATION GAS

The calibration gas used for BTU analysis should be blended of gases specified as Primary Standards. Primary Standard gases are blended using weights that are traceable to the National Institute of Standards and Technology (N.I.S.T). For other applications, the calibration gas should be blended to the specifications detailed in the analyzer's Application Data Sheets.

The calibration gas should not have any component that could drop out at the coldest temperature to which the gas will be subjected. A typical blend for a temperature of zero degrees Fahrenheit is listed in the following table (Table C-1). No dropout will occur in this calibration gas if it is blended at a pressure below 250 psig.

Table C-1 Contents of Example Calibration Gas

Gas	Mole Percent
Nitrogen	2.5
Carbon Dioxide	0.5
Methane	Balance
Propane	1.0
Isobutane	0.3
N-butane	0.3
Neopentane	0.1
Isopentane	0.1
N-pentane	0.1
N-hexane	0.03

The sampling system should be carefully planned for the best chromatographic analyses.

APPENDIX D, ENGINEERING DRAWINGS

D.1 LIST OF ENGINEERING DRAWINGS

This addendum contains the following engineering drawings for the Model 700 Gas Chromatograph.

BE-21154	Assembly Modem Board Model 700 GC
CE-20765	Assembly CPU 2350A/700 (Sheets 1 and 2)
CE-20931	Assembly Radial 6-port Valve, Kiosk Oven Model 700 GC
CE-20958	Assembly 10-port Valve Model 700 GC
CE-21276	Assembly Micro-FID Model 700 GC
CE-21345	Methanator Assembly
CE-25002	C9+ Flow Config. Det. 1 B/F to Meas.D/C Det. 2 to Meas. Model 700
CE-25003	C6+ Flow Config. Det. 1 B/F to Meas.D/C Det. 2 to Meas. Model 700
CE-25004	C6+ Flow Config. Det. 1 B/F to Meas.to Meas. Model 700
CE-25006	C6+ and O_2 Flow Config. Det. 1 B/F to Meas.D/C, DC Model 700

CE-25007	Flow Configuration Det. 1 B/F to Meas. (Helium) Det. 2 B/F to Meas. (Argon) Model 700
DE-20991	Internal Cable Wiring Model 700 Analyzer (Sheets 1 & 2)
DE-20992	Field Wiring Field Termination Board Model 700 GC
DE-20993	Outline and Dimensional Pole, Wall & Floor Mounting Units Model 700 GC
DE-21405	Internal Wiring Micro-FID
SP-00700	Spare Parts List Model 700 GC
SP-00701	Spare Parts List Model 700 GC

APPENDIX E, LOCAL OPERATOR INTERFACE

E.1 INTERFACE COMPONENTS FOR DISPLAYING AND ENTERING DATA

The Local Operator Interface (LOI) has multiple components that you can use to interact with the unit.

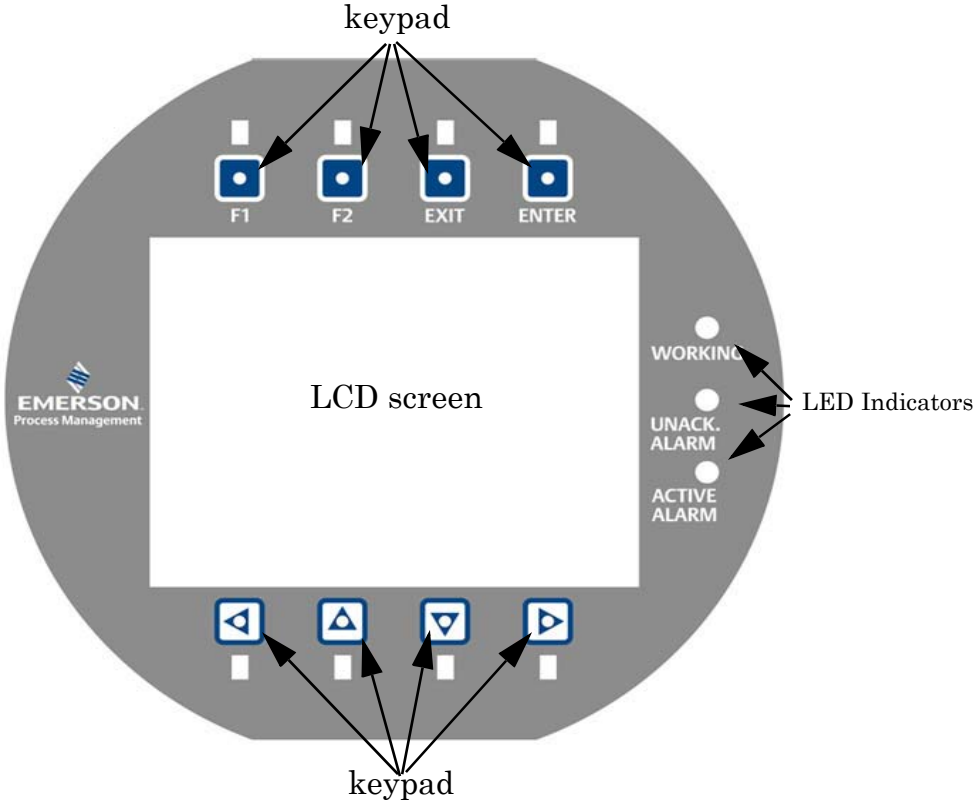


Figure E-1 LOI Unit with Interface Components Listed

E.1.1 Light Emitting Diode Indicators

There are three light emitting diode (LED) status indicators on the Gas Chromatograph (GC) Controller that show the overall status of

the system. These LEDs are positioned to the right of the display screen, and are labelled WORKING, UNACK. ALARM, and ACTIVE ALARM. Each LED, when lit, indicates a specific condition.

Table E-1 GC Conditions Indicated by the LEDs

LED	Color	Condition
WORKING	Green	The GC is currently running an analysis.
UNACK. ALARM	Yellow	The GC has atleast one unacknowledged alarm.
ACTIVE ALARM	Red	The GC has an out-of-tolerance or alarm condition that requires an operator action.

E.1.2 LCD Screen

The LCD screen measures 111.4mm by 83.5 mm and is capable of 320 by 240 QVGA pixel resolution, supporting both text and full graphics. The backlighting, boost, and brightness are all under software control. The boost and brightness levels are user-adjustable.

E.1.3 Keypad

The keypad consists of eight infrared keys. Four of the keys are located above the screen, and the other four keys are located below the screen.

The keys above the LCD screen, from left to right, are labelled F1, F2, EXIT, and ENTER. The keys below the LCD screen, from left to right, are LEFT, UP, DOWN, and RIGHT.

A key is “pressed” by placing a finger on the glass over the associated key hole and then removing the finger. Holding a finger over a key hole will cause that key to auto-repeat. The function of each key is context-sensitive

and therefore will be described as appropriate throughout the remainder of this appendix.

E.1.4 Security Switch

A connector is provided for an externally mounted hall-effect switch. This optional switch can be mounted in the wall of the explosion-proof enclosure and can be locked and sealed using a wire loop and lead seal so that the switch position cannot be changed without breaking the seal.

E.2 USING THE LOCAL OPERATOR INTERFACE

Upon starting the GC, the LOI automatically runs in *Status Display* mode, in which it scrolls through a predefined series of screens, displaying each screen for approximately 30 seconds.

Table E-2 Status Display Mode Screens in Order of Appearance

Status	Displays information about the operational state of the analyzer, including a scrolling list of up to 25 user-selectable parameters that can be defined or modified using the MON 2000 application.
Live Chromatogram	Displays the chromatogram for the current analysis in real time. **NOTE**: This screen does not display if the GC is not currently analyzing a sample.
Active Alarms	Lists active alarms, if any.
Temperature Control	Displays information about the PID temperature control loops.
Valves	Displays the settings and states of the stream and analyzer valves.

After 30 minutes of keypad inactivity, the LOI shifts to *Screen Saver* mode, in which the screen goes blank and the backlight turns off. Pressing any key swithces the LOI from *Screen Saver* mode to *Status Display* mode. At any time while in *Status Display* mode, the **Enter** key or the **F2** key may be pressed to invoke the

Main Menu. Use the **Exit** key to leave the *Main Menu* and return the LOI to *Status Display* mode. If you log onto the GC from the *Main Menu* to perform operations or edit data, when you exit the menu you will automatically be logged off the LOI.

In *Status Display* mode, you can manually scroll to the next screen using the **Right** arrow key, or to the previous screen using the **Left** arrow key. You can pause automatic scrolling at any time by pressing the **Exit** key, and you can resume automatic scrolling by pressing either the **Left** or the **Right** arrow key. Automatic scrolling resumes after ten minutes of keypad inactivity.

NOTICE

Mode 2 and 3 applications will display two Status screens and potentially two Chromatogram screens, one for each detector. The number of Chromatogram screens displayed depends on whether none, one, or both of the detectors are in use.

E.2.1 Navigating the Screen

LOI screens have several functions. They can display data for review; they can display data for editing; and they can be used to initiate activities.

Use the **Up** and **Down** arrow keys to navigate between fields or controls within each drop down menu. Pressing the **Down** arrow key while focus is on the last field of a drop down menu moves the focus to the first field on a screen. Alternatively, pressing the **Up** arrow

key while focus is on the first field of the drop down menu causes the focus to move to the last field.

Within any given screen, the function of the **Enter** key depends upon the context. It can be used to save changes or to initiate an action.

Pressing the **Exit** key closes the currently open screen and discards any changes made to the fields or controls on the screen.

The **F1** and **F2** keys are context dependent. A one-word desrciption of the function of each of these keys displays in a green prompt box directly under the key in the title bar of the top-level full-sized screen. In some cases, **F1** acts as a toggle between scrolling either a line or a page at a time. When this is true, the currently selected option (LN or PG) displays with a green background and black text, while the non-selected option displays with a black background and green text. The **F2** key, when **MAIN** is displayed in its prompt box, closes all screens that were opened through the *Main Menu* and goes back to the *Main Menu*. If edits were made, the operator will be prompted to save or cancel the changes, or to abort the original close request.

When a key is pressed, the word "LED" appears in green in the upper left corner of the top-level full-sized screen to acknowledge that the key closure was recognized.

E.2.2 Editing Numeric Data

Use the **Left** and **Right** arrow keys to move through the individual characters within the field and to select the character to be changed. Use the **Up** and **Down** arrows keys to select the

value of each digit. The possible values are 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, - (minus), . (period), E, and ' ' (space).

The - (minus) value is available for signed numbers.

The . (period) and E values are available for floating-point numbers, except for Retention Times and Timed Event values.

The ' ' (space) value is available for Retention Times and Timed Event values, and for the most significant digit in the "tens" position or greater.

The **Down** arrow key moves backward in the list from the current value of the selected digit.

The **Up** arrow key moves forward in the list from the current value of the selected digit.

The **F1 (BACKSP)** key acts as a backspace, except when editing Retention Times and Timed Event values. It deletes the digit immediately to the left of the current position.

The **Enter** key validates and saves the entry.

The **Exit** key cancels any changes and restores the previous value.

E.2.3 Editing Non-Numeric Data

The function of the keys when editing non-numeric data is context-dependant.

E.2.3.1 PIN fields

PIN fields take numbers (0 - 9) and letters (A - Z).

E.2.3.2 Check Boxes

Press **F1 (SELECT)** to select or clear a check box.

E.2.3.3 Buttons

Press **F1 (EXECUTE)** to 'click' the button and execute the function.

E.2.3.4 Radio Buttons

1. Press **F1 (SELECT)** to select within a group of radio buttons.
2. Use the **Up** and **Down** arrow keys to move through the various radio buttons within the group.
3. Press **Enter** to accept the current selection. Press **Exit** to abort any change and to restore the previous selection.

E.2.3.5 List Boxes

1. Press **F1 (SELECT)** to switch the list box to edit, or selection, mode.
2. Use the **Up** and **Down** arrows keys to move between the values within the list box.
3. Press **Enter** to accept the current selection. Press **Exit** to abort the new selection and the list box will revert to the previous selection.

E.2.3.6 Combo Boxes

1. Press **F1 (SELECT)** to expand the drop-down list of available values.
2. Use the **Up** and **Down** arrow keys to move between the values.

3. Press **Enter** to select the current value. Press **Exit** to restore the combo box's initial value.

E.2.3.7 Spreadsheets (test)

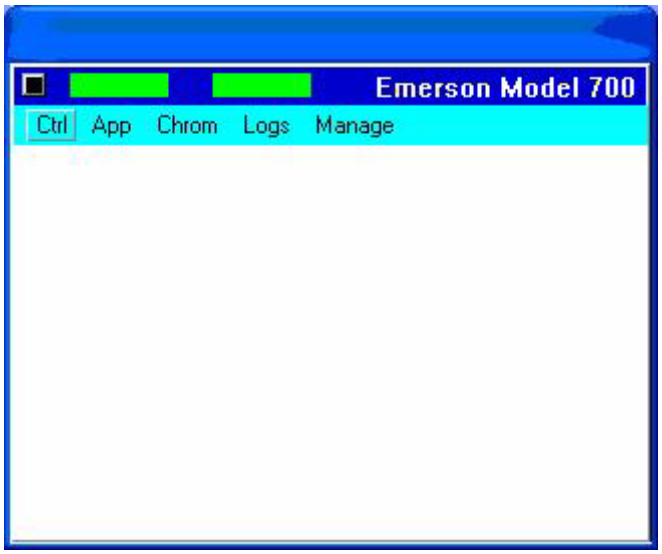
1. Press **F1 (MOVE)** to switch the control to navigation mode.
2. Use the arrow keys to navigate the individual cells.
3. If the cell is editable, press **F1 (EDIT)** to switch the currently-selected cell to edit mode.
4. Edit the cell according to its type (numeric field, combo box, etc.).
5. To discard the changes to the edited cell and return it to its original value, press **Exit**. The 'Save Changes?' dialog appears. Go to Step 9.
6. To accept the change to the edited cell, press **Enter**.
7. Repeat Steps 1 through 7 for any other cells that you want to edit.
8. To save all changes, press Enter. The 'Save Changes?' dialog appears.
9. To save changes, press **F1 (Execute)**. To discard changes, select the **No** button and press **F1 (Execute)**.

E.2.3.8 Tables

A table looks and behaves similarly to a spreadsheet, except a table supports multiple lines of text in each cell, as necessary, and table cells are not editable.

When navigating within a table, press **F1** to toggle between scrolling the screen in Line Mode (LN) or Page Mode (PG). Line Mode scrolls the text in the cell one line at a time, while Page Mode scrolls the text one page at a time.

E.3 NAVIGATING THE LOI MENUS



NOTICE

The top blue "bar" and border that surround the example images of the menus and screens do not exist on the actual LOI. They are the result of screen captures from a Windows-based emulation of the LOI.

The *Main Menu* has five top-level submenus: *Crtl*, *App*, *Chrom*, *Logs*, and *Manage*.

Use the four arrow keys to navigate between the submenus.

Press **Enter** to access the selected submenu.

Press **Esc** to collapse an open submenu.

If no submenus are open, pressing **Esc** closes the *Main Menu* and logs off the user.

Table E-3 List of Submenus and Commands

MAIN MENU	
Submenu	**Command**
Crtl	
	Auto Sequence
	Single Stream
	Halt
	Calibration
	Stop Now
App	
	System
	Status
	Component Data
	Time Event Table
	Valves
	Temperature Control
Chrom	
	View

Table E-3 List of Submenus and Commands

Logs	
	Maintenance Log
	Event Log
	Alarm Log
	Unacked Logs
	Active Alarms
	Reports → Display
	Reports → Print
Manage	
	Log Off
	LOI Settings

Refer to the *MON2000 Software for Gas Chromatographs User Manual*, P/N 3-9000-522, for detailed information regarding the commands that are available through the submenus.

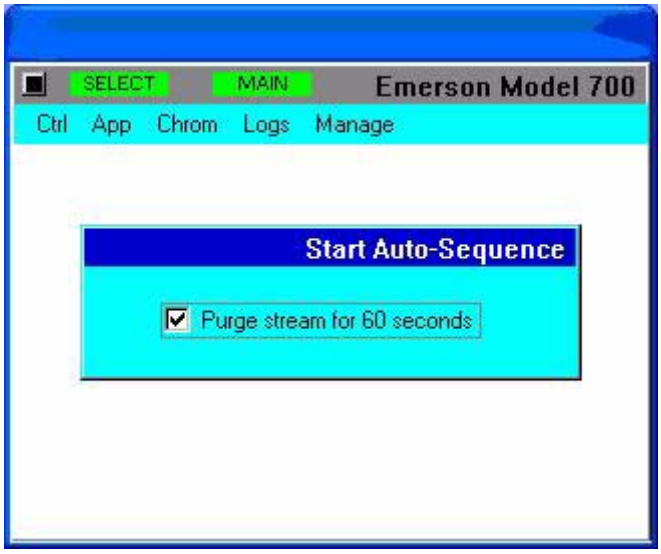
E.3.1 The Ctrl Menu

The *Ctrl* menu enables you to stop, calibrate, or place on automatic control a sample stream from the analyzer. You must log on to the GC to use these functions.

E.3.1.1 Auto Sequence

Use this command to start continuous GC analysis runs that follow a predefined stream sequence. At initial startup, the current stream in the sequence is the first stream analyzed.

1. If you are not logged in, do so.
2. Select *Auto Sequence* from the *Ctrl* submenu. The Start Auto-Sequence screen appears.

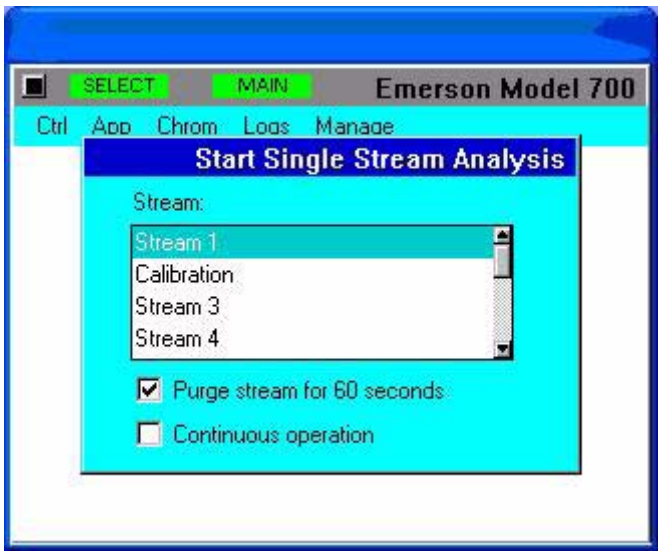


3. If you want to send sample gas through the sample loop for 60 seconds prior to beginning the first analysis, use the **F1** key to check the *Purge stream for 60 seconds* checkbox. The check box is checked by default. If you do not want to purge the sample loop, clear the *Purge stream for 60 seconds* checkbox.
4. Press **Enter** to start auto sequencing, or press **Exit** to abort. The *Main Menu* reappears.

E.3.1.2 Single Stream

Use this function to start GC analysis run(s) on a single stream. At initial startup, the current stream in the sequence is the first stream analyzed.

1. If you are not logged in, do so.
2. Select *Single Stream* from the *Ctrl* submenu. The *Start Single Stream Analysis* screen appears.



3. Press **F1 (Select)** and use the arrow keys to select the desired stream from the Stream: list box.
4. Press **Enter** to accept your selection, or **Exit** to abort.
5. Use the **Down** arrow key to move to the *Purge stream for 60 seconds* check box. If you want to send sample gas through the sample loop for 60 seconds prior to beginning the first analysis, use the **F1** key to check the *Purge stream for 60 seconds*

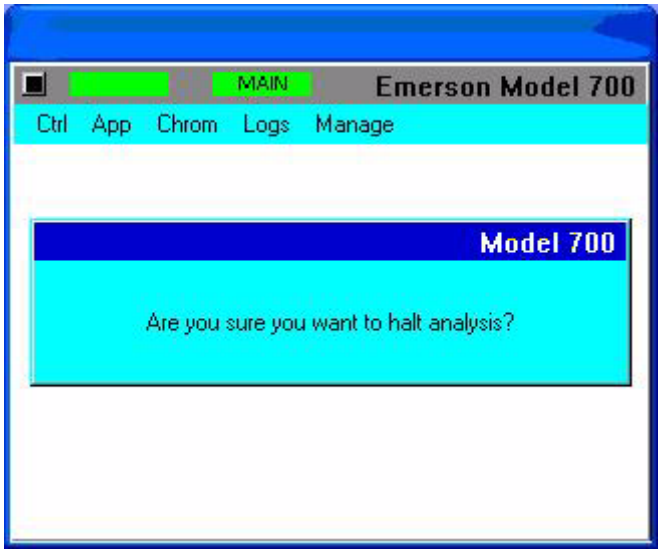
checkbox. The check box is checked by default. If you do not want to purge the sample loop, clear the *Purge stream for 60 seconds* checkbox.

6. Use the **Down** arrow key to move to the *Continuous operation* check box. If you want to perform repetitive analysis runs, use the **F1** key to check the *Purge stream for 60 seconds* checkbox. The check box is cleared by default, which means only a single analysis will be run.
7. Press **Enter** to start the single stream analysis run(s), or press **Exit** to abort. The *Main Menu* reappears.

E.3.1.3 Halt

Use this screen to stop the current operation mode at the end of a run that is in progress.

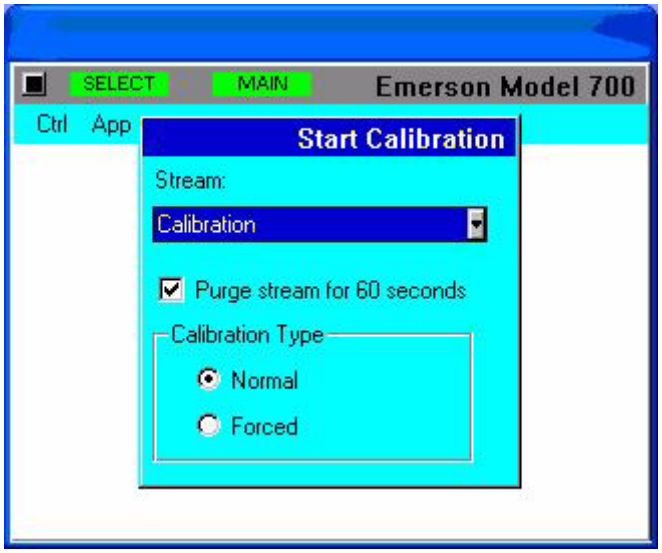
1. If you are not logged in, do so.
2. Select *Halt* from the *Ctrl* submenu. The *Halt* screen appears.



3. Press **Enter** to halt the analysis after the current run finishes, or press **Exit** to abort. The *Main Menu* reappears.

E.3.1.4 Calibrating the GC

1. If you are not logged in, do so.
2. Select *Calibration* from the *Ctrl* submenu. The *Start Calibration* screen appears.



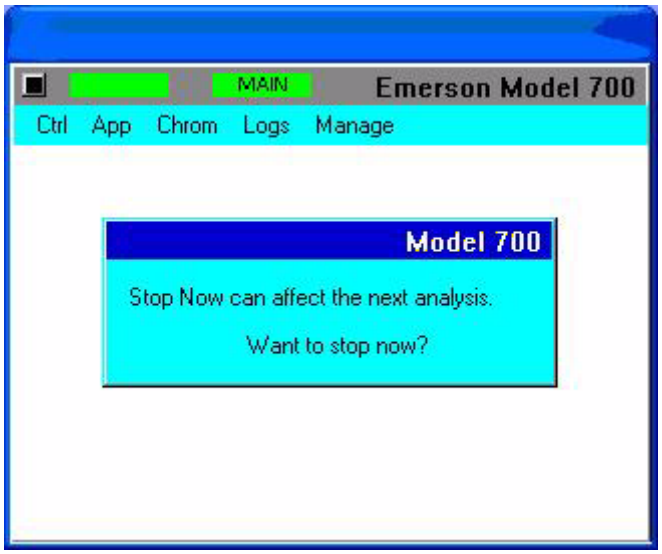
3. Press **F1 (Select)** to open the *Stream:* combo box's drop-down list.
4. Use the **Up** and **Down** arrow keys to move through the drop-down list and to highlight the stream that you want to calibrate. Only streams designated as calibration streams under the *Streams* submenu display in the drop-down list.
5. Press **Enter** to accept your selection, or **Exit** to abort.

6. Use the **Down** arrow key to move to the *Purge stream for 60 seconds* check box. If you want to send sample gas through the sample loop for 60 seconds prior to beginning the first analysis, use the **F1** key to check the *Purge stream for 60 seconds* checkbox. The check box is checked by default. If you do not want to purge the sample loop, clear the *Purge stream for 60 seconds* checkbox.
7. Use the **Down** arrow key to move to the Calibration Type section. Use **F1 (Select)** to enable navigation between the *Normal* and *Forced* check boxes. Use the **Up** or **Down** arrow key to select your choice. If you want the CDT for the selected stream(s) to be updated with the new Response Factors only if all Response Factors are within acceptable deviations, select *Normal*. If you want the CDT for the selected stream(s) to be updated with raw data regardless of acceptable deviations, select *Forced*.
8. Press **Enter** to accept your selection, or press **Exit** to abort.
9. Press **Enter** to start the calibration, or press **Exit** to abort. The *Main Menu* reappears.

E.3.1.5 Stop Now

Use this screen to immediately stop all analysis and calibration runs.

1. If you are not logged in, do so.
2. Select *Stop Now* from the *Ctrl* submenu. The *Stop Now* screen appears.



3. Press **Enter** to immediately halt the current GC activity, or press **Exit** to abort. The GC goes into idle mode and the *Main Menu* reappears.

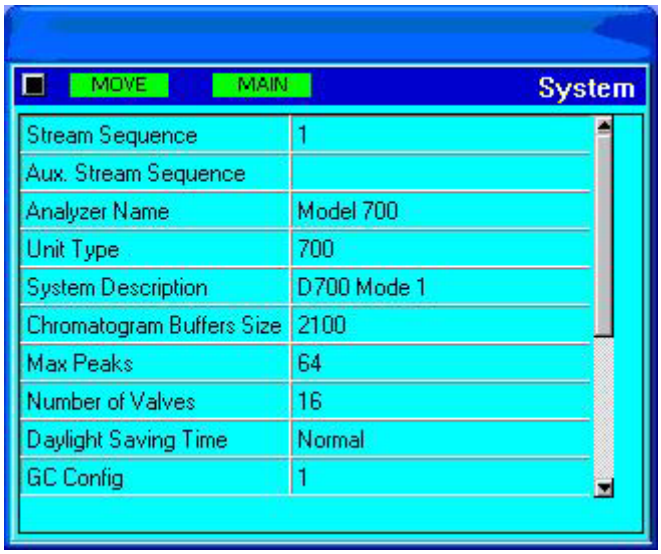
E.3.2 The App Menu

The *App* menu commands allow you to view, and in some cases edit, application-specific parameters, such as retention times, calibration concentrations, Timed Event values, and valve settings.

E.3.2.1 System

Use this read-only screen to view various system parameters such as the Stream sequence, Unit name, and System description.

1. Select *System* from the *App* submenu. The *System* screen appears.

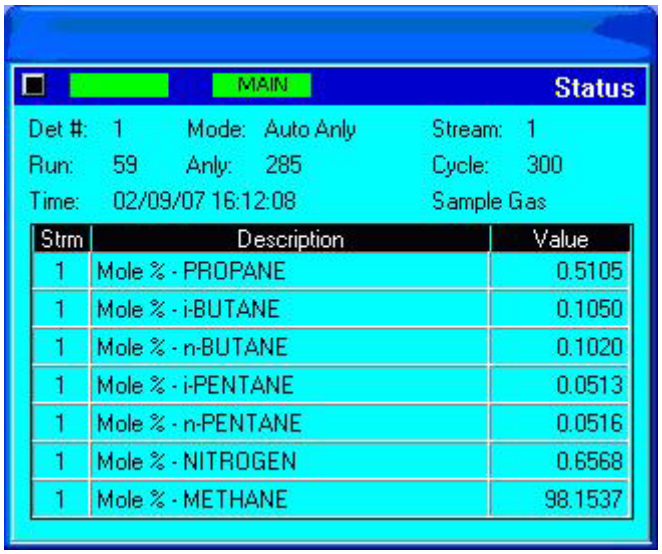


2. To scroll thru the list, press the **F1 (Move)** key.
3. Use the **Up** and **Down** arrow keys to scroll through the list .
4. Press **Enter** or **Exit** to switch from scrolling mode.
5. Press **Exit** to leave this screen and return to the *Main Menu*.

E.3.2.2 Status

Use this screen to view various parameters about the current operational state of the controller, such as the Mode, Current Stream, Run time, Analysis time, and Cycle time. You can also view an automatically scrolling list of user-specifiable parameters that can be configured using MON2000.

1. Select *Status* from the *App* submenu. The *Status* screen appears.

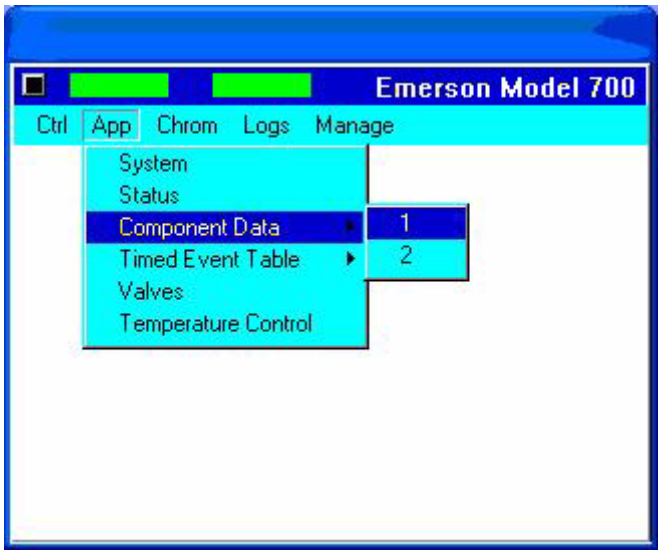


2. Press **`Exit`** to leave this screen and return to the *Main Menu*.

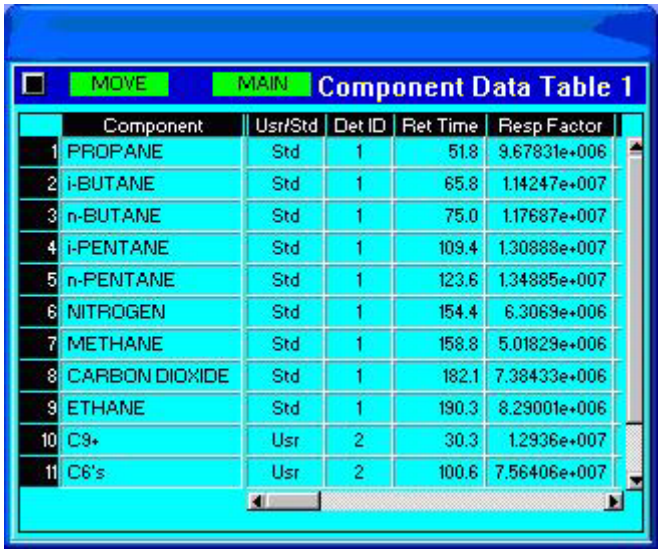
E.3.2.3 Component Data

Use this menu item to view and edit a Component Data Table.

1. Select *Component Data* from the *App* submenu.



2. Select the number for the Component Data table that you want to view or edit from the *Component Data* submenu. The *Component Data Table* screen appears.



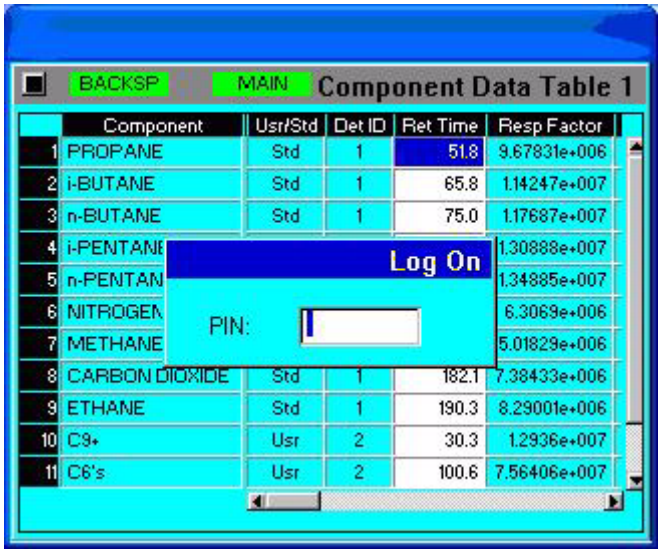
	Component	Usr/Std	Det ID	Ret Time	Resp Factor
1	PROPANE	Std	1	51.8	9.67831e+006
2	i-BUTANE	Std	1	65.8	1.14247e+007
3	n-BUTANE	Std	1	75.0	1.17687e+007
4	i-PENTANE	Std	1	109.4	1.30888e+007
5	n-PENTANE	Std	1	123.6	1.34885e+007
6	NITROGEN	Std	1	154.4	6.3069e+006
7	METHANE	Std	1	158.8	5.01829e+006
8	CARBON DIOXIDE	Std	1	182.1	7.38433e+006
9	ETHANE	Std	1	190.3	8.29001e+006
10	C9+	Usr	2	30.3	1.2936e+007
11	C6's	Usr	2	100.6	7.56406e+007

3. To navigate the list of components, press **F1(Move)**.

4. Use the **Up**, **Down**, **Left**, and **Right** arrow keys to scroll horizontally or vertically through the list.

   Editable fields display in white while non-editable fields display in cyan. Only the fields in the Retention Time and Calibration Concentration columns are editable, and you must be logged in to edit these fields.

5. To edit a value, navigate to that cell and press **F1 (Edit)**. If you are not logged in, the *Log On* screen appears, allowing you to log in. Enter your PIN and press **Enter**.



6. After editing the selected field, press **Enter** to accept your changes or press **Exit** to cancel the operation. If you want to edit another cell, navigate to it and repeat the process by pressing **F1 (Edit)**. You can edit and accept or cancel as many fields as you require.

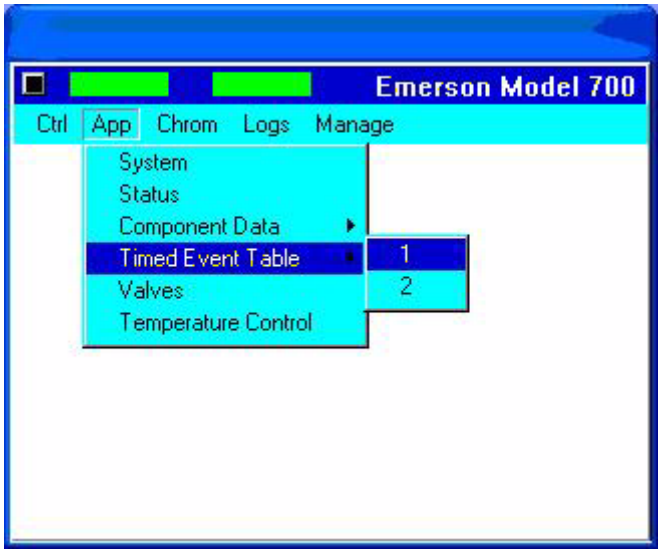
7. Press **Enter** or **Exit** to switch from scrolling mode.

8. Press **Enter**. The *Save changes?* prompt appears.
9. Press **Enter** to save your changes or press the **Down** arrow key once and then press **Enter** to discard them.
10. Press **Exit** to leave the *Component Data* screen and return to the *Main Menu*.

E.3.2.4 Timed Event Table

Use this screen to view and edit Timed Event Tables.

1. Select *Timed Event Table* from the *App* submenu.



2. Select the number for the Timed Event Table that you want to view or edit from the *Timed Event Table* submenu. The *Timed Events* screen appears.

MOVE
MAIN
Timed Events 1
SFLO1 Off 0.0
Inhibit On Det 1 0.0
Inhibit On Det 2 0.0
Valve # 2 - Dual Column On 1.0
Slope Sens 10 Det 2 2.0
Peak Width 4 Det 1 3.0
Slope Sens 8 Det 1 4.0
Peak Width 4 Det 2 4.0
Valve # 3 - S/BF 2 On 5.0
Valve # 1 - S/BF 1 On 5.0

3. To navigate the list of events, press **F1(Move)**.
4. Use the **Up**, **Down**, **Left**, and **Right** arrow keys to scroll horizontally or vertically through the list.

   Editable fields display in white while non-editable fields display in cyan. Only the fields in the Time column are editable, and you must be logged in to edit these fields.
5. To edit a value, navigate to that cell and press **F1 (Edit)**. If you are not logged in, the *Log On* screen appears, allowing you to log in. Enter your PIN and press **Enter**.

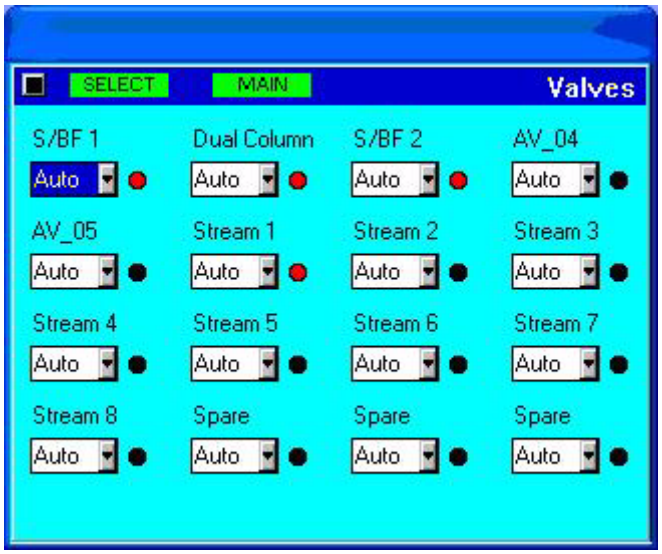
6. Use the **Up** and **Down** arrows to change the cell's value.
7. After editing the selected field, press **Enter** to accept your changes or press **Exit** to cancel the operation. If you want to edit another cell, navigate to it and repeat the process. You can edit and accept or cancel as many fields as you require.
8. Press **Enter** or **Exit** to switch from scrolling mode.
9. Press **Enter**. The *Save changes?* prompt appears.
10. Press **Enter** to save your changes or press the **Down** arrow key once and then press **Enter** to discard them.
11. Press **Exit** to leave the *Timed Events* screen and return to the *Main Menu*.

E.3.2.5 Valves

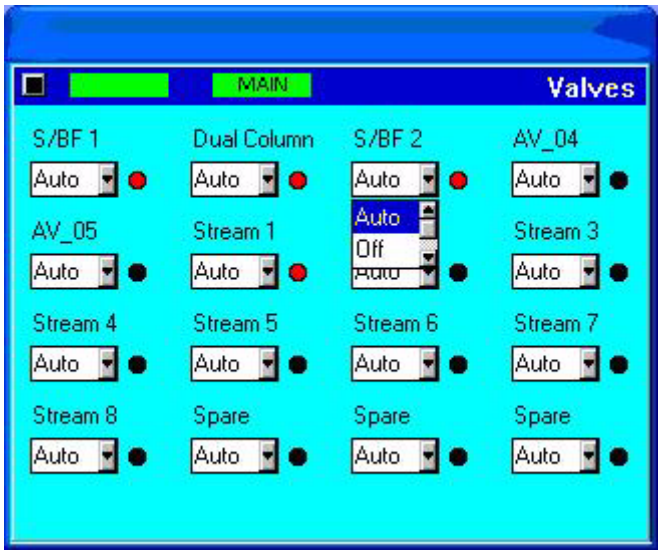
Use this screen to monitor valve operation and to control valve operational modes.

1. Select *Valves* from the *App* submenu. The *Valves* screen appears.

   The round indicators to the right of each combo box reveal the current state of a valve. A red indicator means the valve is on and a black indicator means the valve is off.



2. To change a valve's operational mode, use the **Up** or **Down** arrow keys to move to the desired valve.
3. Press **F1 (Select)**. The combo box opens and a drop-down list box appears.



4. Use the **Up** or **Down** arrow keys to select the desired operational mode.

Table E-4 Operational Modes for Valves

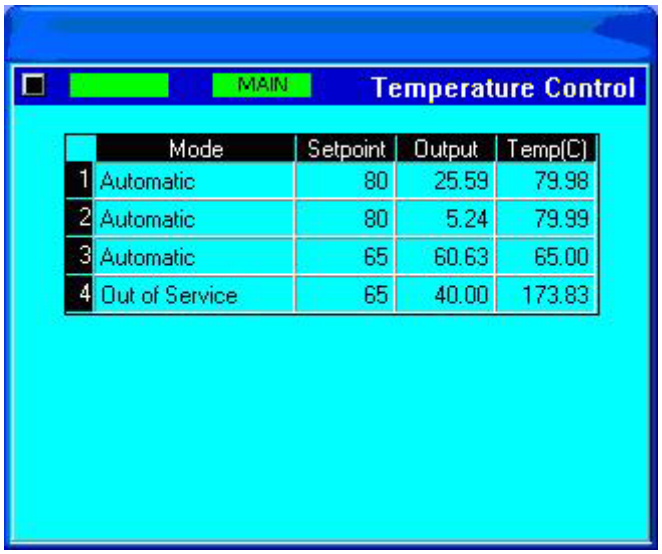
Auto	Valve operation is controlled by the GC application.
Off	Valve is closed.
On	Valve is open.
Test	Valve fires alternately on and off, once per second for 20 cycles and when done, goes into Auto mode.

5. Press **Enter** to accept your selection or **Exit** to cancel it.
6. Press **Exit** to leave the *Valves* screen and return to the *Main Menu*.

E.3.2.1 Temperature Control

Use this menu option to monitor the temperatures of the oven and the Stream Switching Block to determine when the GC is thermally stable.

1. Select *Temperature Control* from the *App* submenu. The *Temperature Control* screen appears.



2. Press **Exit** to leave the *Temperature Control* screen and return to the *Main Menu*.

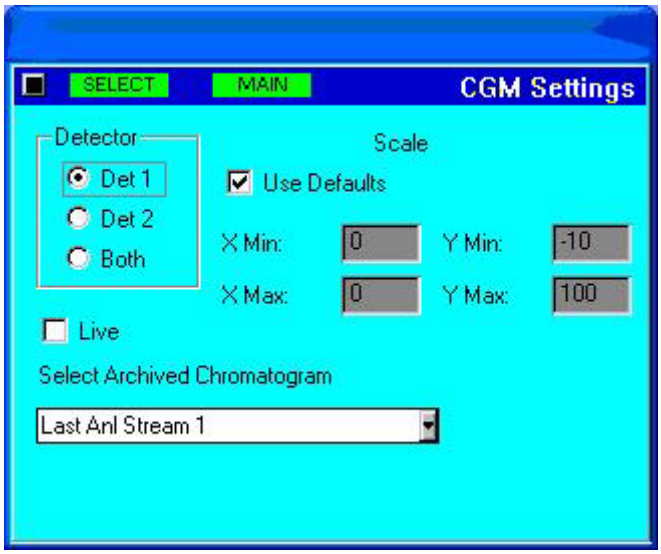
E.3.3 The Chrom Menu

Use this menu item to display a chromatogram, live or archived. The GC saves the most recent chromatogram from each stream in the stream sequence as well as the chromatogram for the most recent calibration run for each CDT.

1. Select *View* from the *Chrom* submenu. The *CGM Settings* screen appears.

   You can view live or archived chromatograms for up to two detectors. If the GC has one detector, the *Det 2* and *Both* check boxes will be grayed out. If the GC is Idle, the *Live* check box will be grayed out, and you can only view archived

chromatograms. If no analyses or calibrations have been run, the *Selected Archive Chromatogram* combo box will be available on the *CGM Settings* screen. If you select a live chromatogram, the *X Min* field will be grayed out and set to 0.



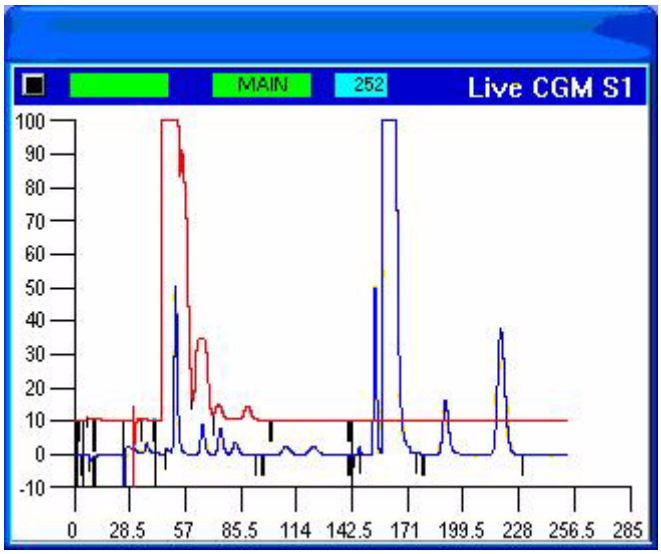
2. To select the check box from the *Detector* section for the detector(s) whose chromatogram(s) you want to view, press **F1 (Select)**.
3. Use the **Up** or **Down** arrow key to move to the desired option.
4. Press **Enter** to accept your selection or **Exit** to cancel.
5. Use the **Down** arrow key to move to the *Use Defaults* check box. If you do not want to modify the scaling, skip to Step 7, otherwise, press **F1 (Select)** to clear the

Use Defaults check box and continue to Step 5.

Table E-5 Scaling Values Defintions

X Min	Can only be edited when viewing Archive CGMs. This option is grayed out when a live CGM is selected. The default is zero.
Y Min	The default value is -10.
X Max	The default value is the same as the cycle time. The minimum value when editing the scaling must be greater than X Min + 10.
Y Max	The default value is 100. The minimum value when editing the scaling must be greater than Y Min + 10.

6. To change a scaling value, use the **Up** or **Down** arrow keys to move to the desired axis and press **F1 (Edit)**.
7. Use the **Left** and **Right** arrow keys to select the field.
8. Press **F1 (Backspace)** to delete the digit immediately to the left of the cursor.
9. Use the **Up** and **Down** arrow keys to edit the scale values.
10. Press **Enter** to accept the change. The CGM Setting screen exits Edit Mode.
11. Repeat the editing steps until all scales are changed as desired.
12. After changing the values, press **Enter** to accept the new values or press **Exit** to cancel them.
13. Use the **Down** arrow key to move to the *Live* check box.
14. To view a live chromatogram, press **F1 (Select)** and **Enter**. The *Live CGM* screen appears.

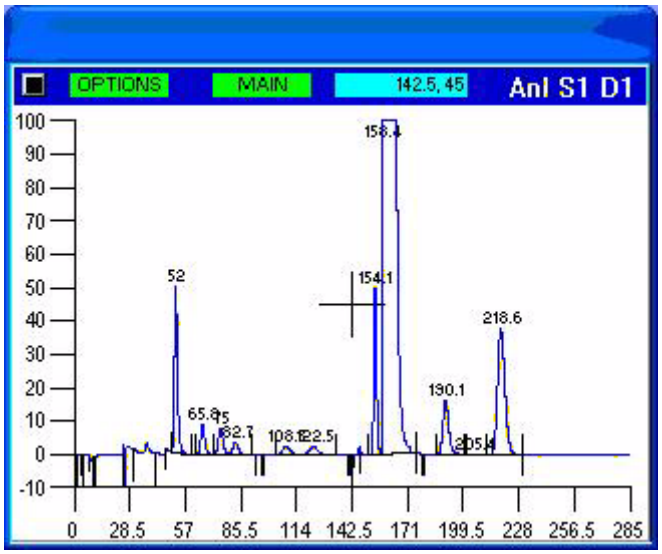


The screen displays a chromatogram in real time for the detector(s) that you selected from the *CGM Settings* window. In addition to the detector data, tick marks appear along the plot to indicate timed events as they occur. When first invoked, the plot may take a few seconds to process and display the current results of the ongoing analysis, after which, new data is drawn as it becomes available. The run time for the current analysis displays (in seconds?) in the cyan box located in the title bar at the top of the screen.

If the *X max* scaling value was modified to a value less than the analysis time, the chromatogram scrolls by one X-axis tick mark interval each time the end of the screen is reached. When the current analysis is complete, the plot clears, and the next analysis displays as its data becomes available.

Press **Exit** at any time to close this screen and return to the *CGM Settings* screen.

15. To view an archived chromatogram, clear the *Live* checkbox, if necessary, by pressing **F1 (Select)**.
16. Use the **Down** arrow key to move to the *Select Archived Chromatogram* combo box.
17. Press **F1 (Select)** to open the combo box's drop-down list of available chromatograms.
18. Use the **Up** or **Down** arrow keys to select the desired stream to view and press **Enter** to accept your selection. The archived chromatogram screen appears.



The archived chromatogram screen displays an archived chromatogram for the stream that you selected from the *Select Archived Chromatogram* combo box. By default, the screen shows the retention time for a peak directly above it. Integration baselines and integration start and stop tick marks also display on the screen, in addition to the

timed event tick marks.

A cursor displays as a black '+' in the middle of the plot. Use the arrow keys to move the cursor in the desired direction. The new coordinates update after each movement in the cyan box in the title bar at the top of the screen. If the plot has been zoomed in, the cursor will move as far as possible in the desired direction until it has no more room to move. At this point, assuming that there is more of the chromatogram available in that direction, the plot scrolls by one axis tick interval.

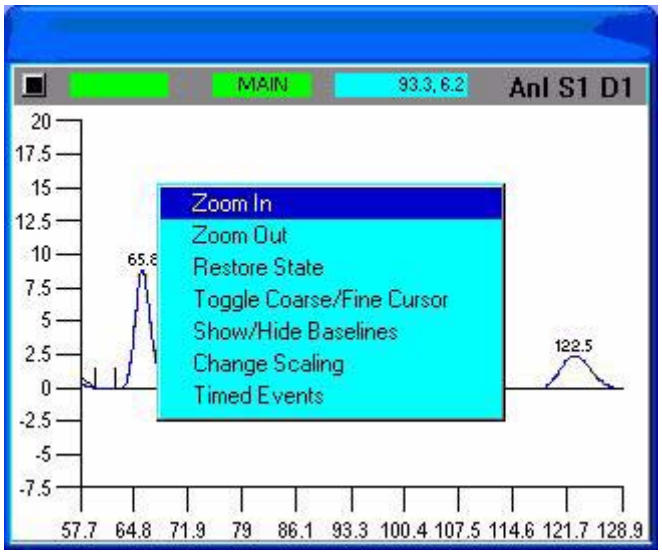
For information on manipulating the archived chromatogram screen, see Section E.3.3.1.

19. Press **Exit** to leave the *CGM Settings* screen and return to the *Main Menu*.

E.3.3.1 Working with the Archived Chromatogram Screen

You have several options in viewing the data displayed on the archived chromatogram screen.

1. While viewing the archived chromatogram screen, press **F1 (Options)**. The options menu appears.



2. Select the desired function and press **Enter**, or press **Exit** to close the menu and return to the archived chromatogram screen.

Table E-6 Definition of Archived Chromatogram Screen Options

Zoom in	Zooms in using the cursor position as a reference point, cutting the visible portion of the plot in half.
Zoom out	Zooms .out using the cursor position as a reference point, doubling the visible portion of the plot.
Restore State	Restores the plot to the default scaling coordinates (X-axis: 0 to analysis time, Y-axis: -10 to 100).
Toggle Coarse/Fine Cursor	By default, the coarse cursor, which is larger and less accurate, is visible. Selecting this option will toggle between the coarse cursor and the finecursor, which is smaller and more accurate.
Show/Hide Baselines	Selecting this option toggles between displaying the plot with or with out the peak retention times, integration baselines, and integration start and stop tick marks.

Table E-6 Definition of Archived Chromatogram Screen Options

Change Scaling	Displays the *CGM Scaling* screen. Use the **Up** or **Down** arrow key to navigate to the value(s) you want to modify. To edit a value, press **F1 (Edit)**. After modifing the values, press **Enter** to accept them, or **Exit** to cancel them. Press **Enter** to redraw the plot using the new scale.
Timed Events	Displays the *Timed Event Table* screen for the Timed Event Table associated with the chromatogram.

E.3.4 The Logs Menu

The *Logs* menu gives you the following options:

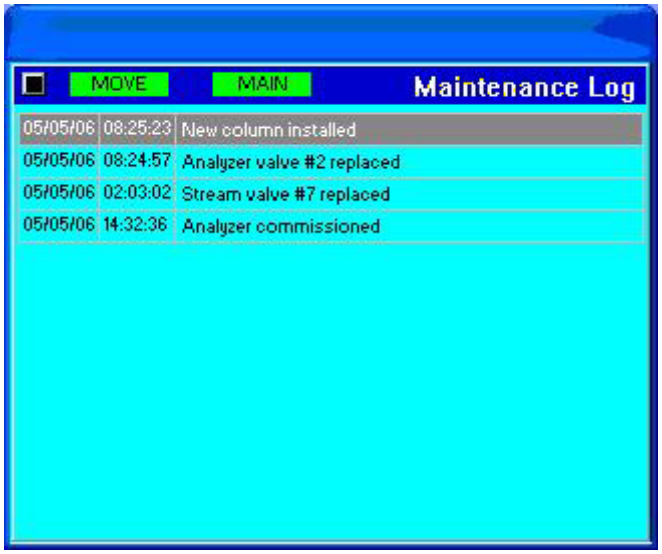
- View historic maintenance information.
- View historic operator actions and changes.
- View historic alarm conditions and alarm history.
- View or send reports to the GC's printer.

E.3.4.1 Maintenance Log

Use this menu item to view a read-only log of maintenance activities on a GC.

1. Select *Maintenance Log* from the *Logs* submenu. The *Maintenance Log* screen

appears.



2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.
3. Press **Exit** to close the *Maintenance Log* screen and to return to the *Main Menu*.

E.3.4.2 Event Log

Use this menu item to view a read-only log of the system and operator events that have occurred on a GC. This screen refreshes once a minute.

1. Select *Event Log* from the *Logs* submenu. The *Event Log* screen appears.

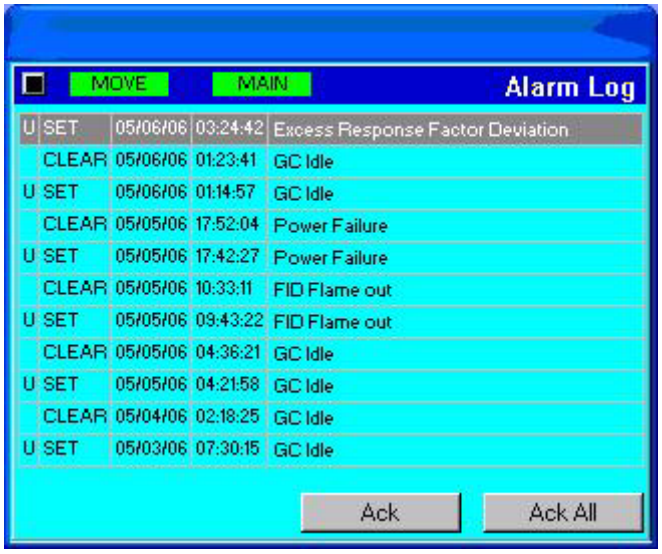
MOVE
MAIN
Event Log
daniel 07/01/06 08:35:36 anlin[4].label, Old: <4 > New: < >
daniel 07/01/06 08:35:36 anlin[3].label, Old: <3 > New: < >
daniel 07/01/06 08:35:36 anlin[2].label, Old: <2 > New: < >
daniel 07/01/06 08:35:36 anlin[1].label, Old: <1 > New: < >
daniel 07/01/06 08:35:26 anlin[4].label, Old: < > New: <4 >
daniel 07/01/06 08:35:26 anlin[3].label, Old: < > New: <3 >
daniel 07/01/06 08:35:26 anlin[2].label, Old: < > New: <2 >
daniel 07/01/06 08:35:26 anlin[1].label, Old: < > New: <1 >
daniel 07/01/06 08:33:12 ADC700 Electrometer Gain Set to Low
daniel 07/01/06 08:32:15 ADC700 Flame Mode Set to Auto
daniel 06/30/06 15:23:52 cdt[1][1].rt, Old: 9678310 New: 9678317
daniel 06/29/06 13:09:12 ADC700 Flame Lit
daniel 06/29/06 13:08:32 ADC700 H2 Valve Opened

2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.
3. Press **Exit** to close the *Event Log* screen and to return to the *Main Menu*.

E.3.4.3 Alarms Log

Use this menu item to read or acknowledge the various entries in the Alarm Log. The log always displays the 50 most recent events and refreshes once a minute.

1. Select *Alarm Log* from the *Logs* submenu. The *Alarm Log* screen appears.


MOVE
MAIN
Alarm Log
U SET 05/06/06 03:24:42 Excess Response Factor Deviation
CLEAR 05/06/06 01:23:41 GC Idle
U SET 05/06/06 01:14:57 GC Idle
CLEAR 05/05/06 17:52:04 Power Failure
U SET 05/05/06 17:42:27 Power Failure
CLEAR 05/05/06 10:33:11 FID Flame out
U SET 05/05/06 09:43:22 FID Flame out
CLEAR 05/05/06 04:36:21 GC Idle
U SET 05/05/06 04:21:58 GC Idle
CLEAR 05/04/06 02:18:25 GC Idle
U SET 05/03/06 07:30:15 GC Idle
Ack
Ack All

2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.

3. To acknowledge a single alarm, do the following:

   (a) Scroll through the log until the desired alarm is highlighted and press **Enter** to exit scrolling mode.

   (b) Press the **Down** or **Up** arrow key until the **Ack** button is highlighted.

(c) Press **F1 (Execute)** to acknowledge the selected alarm. The screen refreshes and clears the unacknowledged alarm from the *Unacked Alarm* screen.

4. To accept all unacknowledged alarms, do the following:

   (a) Press the **Up** or **Down** arrow key until the **Ack All** button is highlighted.

   (b) Press **F1 (Execute)**. The system acknowledges all of the unacknowledged alarms and the screen refreshes and clears all the unacknowledged alarms from the *Unacked Alarm* screen. The screen displays the 'No Unacknowledged Alarms' message.

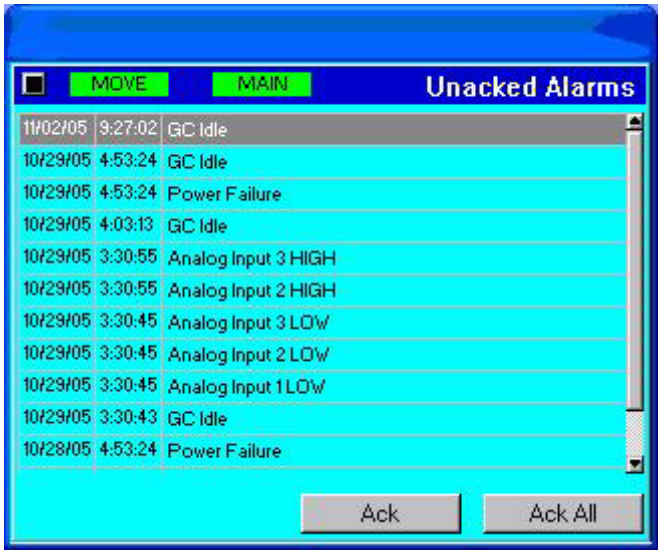
5. Press **Exit** to close the *Alarm Log* screen and to return to the *Main Menu*.

E.3.4.4 Unacked Alarms Log

Use this menu item to read or accept the unacknowledged alarms in the system. The screen refreshes once a minute.

1. Select *Unacked Alarms* from the *Logs* submenu. The *Unacked Alarms* screen

appears.



2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.
3. To acknowledge a single alarm, do the following:
   (a) Scroll through the log until the desired alarm is highlighted and press **Enter** to exit scrolling mode.
   (b) Press the **Down** or **Up** arrow key until the **Ack** button is highlighted.
   (c) Press **F1 (Execute)** to acknowledge the selected alarm. The screen refreshes and

clears the 'U' status indicator from the acknowledged alarm.

4. To accept all unacknowledged alarms, do the following:

   (a) Press the **Up** or **Down** arrow key until the **Ack All** button is highlighted.

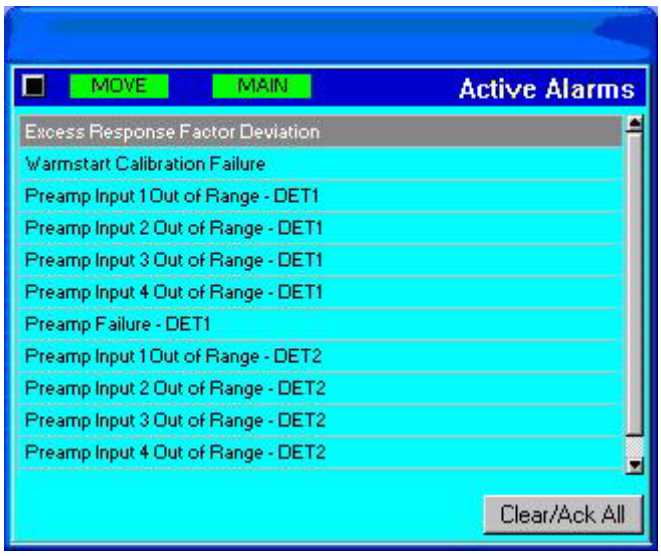
   (b) Press **F1 (Execute)**. All unacknowledged alarms will be acknowledged and the screen refreshes and clears the 'U' status indicators from the acknowledged alarms.

5. Press **Exit** to close the *Unacked Alarms* screen and to return to the *Main Menu*.

E.3.4.5 Active Alarms

Use this screen to read, acknowledge, or clear the active alarms in the system. This screen refreshes once a minute.

1. Select *Active Alarms* from the *Logs* submenu. The *Active Alarms* screen appears.


MOVE
MAIN
Active Alarms
Excess Response Factor Deviation
Warmstart Calibration Failure
Preamp Input 1 Out of Range - DET1
Preamp Input 2 Out of Range - DET1
Preamp Input 3 Out of Range - DET1
Preamp Input 4 Out of Range - DET1
Preamp Failure - DET1
Preamp Input 1 Out of Range - DET2
Preamp Input 2 Out of Range - DET2
Preamp Input 3 Out of Range - DET2
Preamp Input 4 Out of Range - DET2
Clear/Ack All

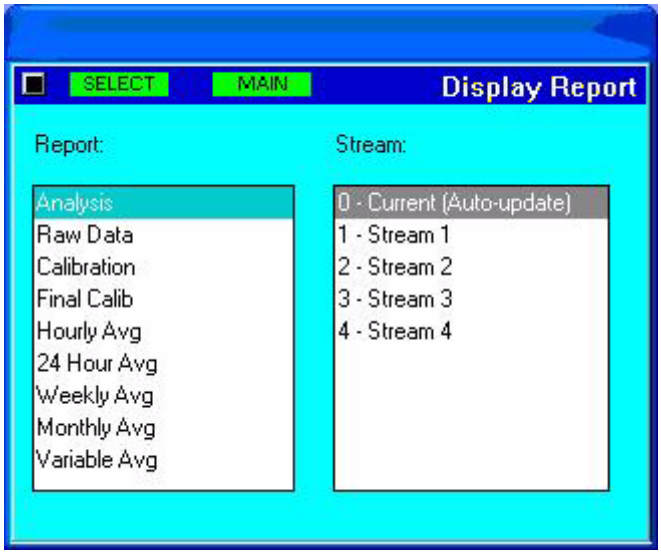
2. If a vertical scroll bar is present, press **F1 (Move)** to switch to scrolling mode, and use the **Up** and **Down** arrow keys to scroll through the log. There are two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Enter** or **Exit** to exit scrolling mode.
3. To acknowledge and clear active alarms, do the following:
   (a) Press the **Up** or **Down** arrow key until the **Clear/Ack All** button is highlighted.
   (b) Press **F1 (Execute)**. All alarms will be acknowledged and cleared, and the screen refreshes and displays the following message: **No active alarms**.
4. Press **Exit** to close the *Active Alarms* screen and to return to the *Main Menu*.

E.3.4.6 Display Report

Use this screen to select the report you want to display.

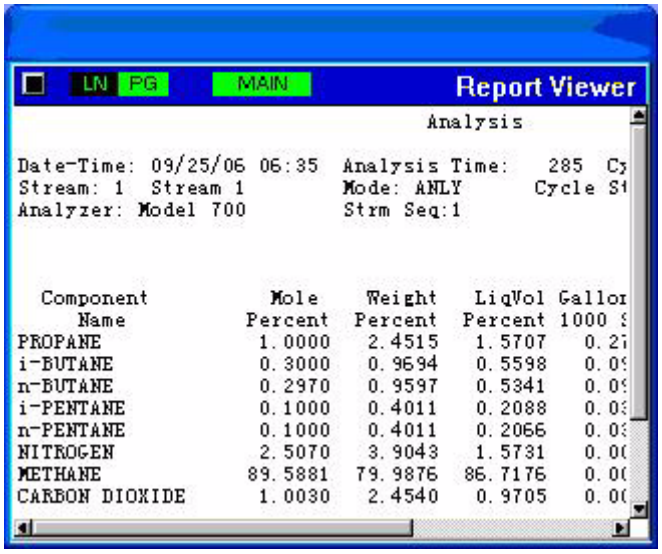
1. Select *Display Report* from the *Logs* submenu. The *Display Report* screen appears. The default selections are Analysis (in Report Column) and Current (in Stream Column). If an analysis is running, hit **Enter** to display a report for the last

analysis on the current stream.



2. Press **F1 (Select)** to allow navigation in the *Report* list box.
3. Press either the **Up** or **Down** arrow key until the desired report is highlighted.
4. Press **Enter** to accept your selection.
5. Press either the **Up** or **Down** arrow key to go to the *Stream* list box.
6. Press **F1 (Select)** to allow navigation within the list box.
7. Press either the **Up** or **Down** arrow key until the desired stream is highlighted.
8. Press **Enter** to accept your selection.
9. To display the selected report on the *Report Viewer* screen, press **Enter**, or press **Exit**

to cancel and return to the *Main Menu*.

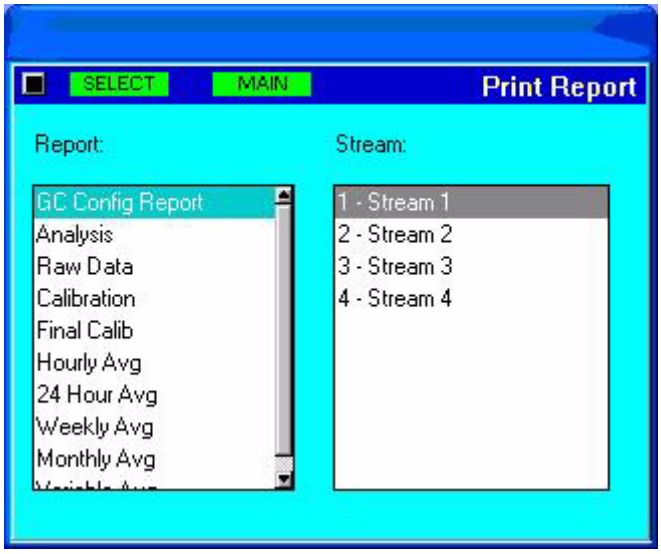


The *Report Viewer* screen has two scrolling modes, a line-by-line (LN) or page-by-page (PG). The default mode is page-by-page. To toggle between modes, press **F1 (LN/PG)**. The currently selected mode displays in green with black text in the **F1** prompt box, while the non-selected mode displays in black with green text. Press **Exit** to close the *Report Viewer* screen and return to the *Main Menu*.

E.3.4.7 Print Report

Use this menu item to select the report you want to print on the GC's local printer.

1. Select *Print Report* from the *Logs* submenu. The *Print Report* screen appears.



2. Press **F1 (Select)** to allow navigation in the *Report* list box.
3. Press either the **Up** or **Down** arrow key until the desired report is highlighted.
4. Press **Enter** to accept your selection.
5. Press either the **Up** or **Down** arrow key to go to the *Stream* list box.
6. Press **F1 (Select)** to allow navigation within the list box.
7. Press either the **Up** or **Down** arrow key until the desired stream is highlighted.
8. Press **Enter** to accept your selection.
9. To print the report, press **Enter**, or press **Exit** to cancel and return to the *Main Menu*.

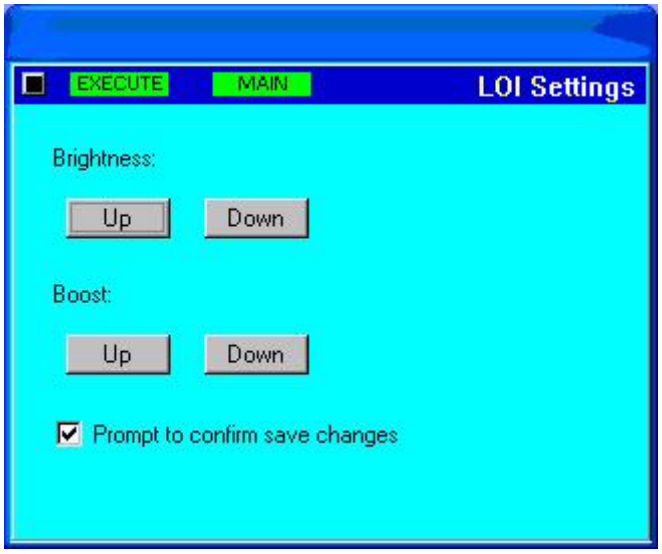
E.3.5 The Manage Menu

The *Manage* menu commands allows you to log off from the GC and to adjust the LCD screen's boost and brightness levels.

E.3.5.1 LOI Settings

Use this menu item to control the appearance of the LCD screen and to turn on or off the default prompting to confirm saving changes.

1. Select *LOI Settings* from the *Manage* submenu. The *LOI Settings* screen appears.



2. To increase or decrease either Brightness or Boost, navigate to the desired **Up** or **Down** button using the **Up** or **Down** arrow key.
3. Press **F1 (Execute)** as many times as necessary to achieve the level of brightness or boost that you desire. The new level(s) will become the default setting for the LCD screen.

4. To disable or enable the *Confirm on Save* prompt that appears whenever you accept changes, do the following:

   (a) Navigate to the *Prompt to confirm save changes* check box and press **F1 (Select)**.

   (b) Press **Enter** to save your selection or **Exit** to cancel and return to the *Main Menu*.

WARRANTY CLAIM PROCEDURES

To make a warranty claim, you, the Purchaser, must:

1. Provide Daniel Measurement and Control, Inc. or Rosemount Analytical, Inc. with proof of the Date of Purchase and proof of the Date of Shipment of the product in question.
2. Return the product to Daniel Measurement Services (DMS) within twelve (12) months of the date of original shipment of the product, or within eighteen (18) months of the date of original shipment of the product to destinations outside of the United States. The Purchaser must prepay any shipping charges. In addition, the Purchaser is responsible for insuring any product shipped for return, and assumes the risk of loss of the product during shipment.
3. To obtain Warranty service or to locate the nearest DMS office, sales, or service center call (713) 827-6314, Fax (713) 827-6312, or write to:

   Daniel Measurement Services
   11100 Brittmore Park Drive
   Houston, Texas 77041

   Or contact DMS via **www.emersonprocess.com/daniel**.

4. When contacting DMS for product service, the Purchaser is asked to provide information as indicated on the following page entitled "Customer Repair Report".
5. For product returns from locations outside the United States, it will be necessary for you to obtain the import consignment address so that DMS's customs broker can handle the importation with the U.S. Customs Service.
6. DMS offers both on call and contract maintenance service designed to afford single source responsibility for all its products.
7. DMS reserves the right to make changes at any time to any product to improve its design and to insure the best available product.

This page is intentionally left blank.

CUSTOMER REPAIR REPORT

FOR SERVICE, COMPLETE THIS FORM, AND RETURN IT ALONG WITH THE AFFECTED EQUIPMENT TO CUSTOMER SERVICE AT THE ADDRESS INDICATED BELOW.

COMPANY NAME: _____

TECHNICAL CONTACT:_____ PHONE: _____

REPAIR P. O. #:_____ IF WARRANTY, UNIT S/N:_____

INVOICE ADDRESS: _____

_____

_____

SHIPPING ADDRESS: _____

_____

RETURN SHIPPING METHOD: _____

EQUIPMENT MODEL #:_____ S/N:_____FAILURE DATE: _____

DESCRIPTION OF PROBLEM: _____

_____

_____

WHAT WAS HAPPENING AT TIME OF FAILURE? _____

_____

ADDITIONAL COMMENTS:_____

_____

_____

REPORT PREPARED BY:_____ TITLE: _____

IF YOU REQUIRE TECHNICAL ASSISTANCE, PLEASE FAX OR WRITE THE CUSTOMER SERVICE DEPARTMENT AT:

DANIEL MEASUREMENT SERVICES
DIVISION OF EMERSON PROCESS MANAGEMENT
ATTN: CUSTOMER SERVICE
11100 BRITTMOORE PARK DRIVE
HOUSTON, TEXAS 77041

PHONE: (713) 827-6314
FAX: (713) 827-6312

FOR FASTEST SERVICE CONTACT DANIEL MEASUREMENT SERVICES VIA OUR WEBSITE:
www.emersonprocess.com/daniel

This page is intentionally left blank.

Daniel Measurement and Control, Inc., Daniel Measurement Services, Inc., and Rosemount Analytical Inc., Divisions of Emerson Process Management, reserves the right to make changes to any of its products or services at any time without prior notification in order to improve that product or service and to supply the best product or service possible.

www.emersonprocess.com